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*An account of some experiments made to determine the most eligible construction of galvanic batteries of four elements.** *By* JOHN W. DRAPER, *Christiansville, Mecklenburg county, Va.*

My first intention in constructing a galvanic battery of four elements, was to combine the power of batteries of the old construction, with an additional quantity of electricity, developed during the diffusion of liquids, into each other. Encouraged by the extraordinary power of some of these arrangements, I have attempted to ascertain under what circumstances their action is the greatest.

I took a glass tube, six-tenths of an inch in diameter, and three inches long, and closed its lower extremity with a perforated cork, (*c*.) I then took a piece of thin sheet zinc, seven-eighths of an inch broad, and one-half long, (*z*,) and having coiled it into a small spiral, soldered a copper wire, about three inches long, to it. I passed the wire through the perforated cork, in the tube, and made all water tight, with sealing wax. I took a copper wire, (*b*) six inches long, of the thickness that is used for hanging bells, and coiled two and a half inches of it into a spiral, of sufficient diameter to go with friction into the glass tube, as at *b*. Then, pouring a solution of

* See the number of this Journal for Sept., p. 163.—COM. PUB.

chloride of sodium into the tube, as high as *s*, so as to cover the zinc to the depth of half an inch, I filled the remainder of the tube with dilute muriatic acid.

Things being in this state, there appeared to be no chemical action going on in the apparatus, but on joining the free extremities of the copper wires, hydrogen gas, after a few seconds, made its appearance on the copper spiral, and in the course of thirty seconds, the whole length of the spiral was actively disengaging gas. Its nature was determined, by pouring out a little liquid from the top of the tube, and then applying a taper,—frequent explosions immediately ensued.

On making the polar extremities communicate in a tube of acidulated water, the water was immediately decomposed; hydrogen being evolved from the zinc extremity of the apparatus, and the other wire rapidly oxidizing.

To effect the decomposition of water with a single pair of plates, is a novel fact, (Faraday Chem. Manip. § 978,) it is therefore deserving investigation, what arrangement will perform this in the most efficient manner. The following tabular view of a mass of experiments I have made, led me to construct these batteries in the manner hereafter described. The numbers were determined by the torsion of a glass fibre.

TABLE I.—*Respecting the changes of the electrical current in point of* QUANTITY, *at certain intervals of* TIME.

Tube filled with—	Instant of immersion.		2 mins.	5 mins.	10 mins.
1. Dilute sulphuric acid, specific gravity 1037. Obs.—Gas disengaged from zinc; none, from copper.	1	111	97	80	Uncertain, owing to the disengagement of gas from the zinc, which kept the needles vibrating.
	Ex's. 2	110	95	"	
	3	100	97	"	
2. Solution chloride sodium, sp. gr. 1203. Obs.—no evolution of gas.	1	32	10	7	
	2	32	10½	"	
3. Solution of salt, sp. gr. 1203, in contact ith zinc—sulph. acid, sp. gr. 1037, in contact with copper. Obs.—Hyd. gas, from copper; none, from the zinc.	1	217	no sensible change.	212	do.
	2	230		210	do.
	3	223		210	do.
4. The same well mixed by shaking the tube. Obs.—Zinc disengages hydrogen.	1	123	117	Very dubious, owing to the disengagement of hydrogen, protecting the copper spiral.	

This table shows that at the very first moment of immersion, a wave of electricity flows along the wire, and that immediately afterwards the action of the battery moderates. It likewise shows that the relative power of a battery of four elements being repre-

sented by 223, the same plates charged with dilute sulphuric acid, would only be 111, and with muriate of soda, 32.

TABLE II.—*Respecting the distances of the zinc and copper plates, in the battery with four elements. Charged with sulphuric acid, specific gravity* 1037, *and muriate of soda, specific gravity* 1203, *in experiment* 1, *but* 1145 *and* 1263 *in experiment* 2.

Expt. 1	72	135	185	200	210	221	0
2	78	143	220	257	280	287	0
	2 ins.	1 in.	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	1-16	touching

This table shows, that the most energetic action on the galvanometer takes place when the plates are the nearest to each other without touching.

TABLE III.—*Respecting the specific gravities of the two liquids.*

Specific gravity of the muriate of soda, 1203.	Sp. gr. of the other element.	Torsion.	Remarks.
Muriate of soda & water,	1000	3	zinc gives off hyd'gen.
Mur. soda & suph. acid,	1037	176	
	1071	191	
	1088	213	
	1115	234	copper gives off hyd.
	1150	246	
	1200	doubtful.	
Mixed together by shaking the tube,	1037	102	

This table shows, that as the two liquids approach each other in specific gravity, the activity of the battery is more marked. Two theoretical reasons might be assumed: 1st. The chemical action on the metals is more energetic: 2nd, The infiltration of the liquids is more rapid. It likewise shows, as well as table 1st, that when the infiltration ceases, or the liquids are mechanically mixed, much power is lost.

TABLE III.—*Respecting the chemical nature of the liquids.*

Obs.—Every caution was used in these experiments to make them under similar circumstances, as to distance of the metals, time, &c. &c. The plates were well washed after each trial.

Sol. chloride of sodium by itself, (s. g. 1203.)	Nitric acid & copper, satura. carb. soda & zinc.	Sulph. ac. 1037, & cop., sulph. zinc. satu. & zinc.	Sulph. ac. 1037, & cop. phosp. soda saturat. & zinc.
49	135.166.185.200 The numbers increased as the acid was made stronger.	30	40

Nitric acid 1037, & cop. satu. nitrate amm. & zinc.	Solu. chlorine sat. and cop. chloride sodium 1203, and zinc.	
141	47	

Beside these, I made trial of a great variety of other substances, the general result being, that for purposes of experiment, a solution of common salt, not quite saturated, and dilute sulphuric, or muriatic, or nitric acids, are the most eligible fluids. The nearer they approach the saline solution, in specific gravity, the more energetic is their action,—but then it is more transient.

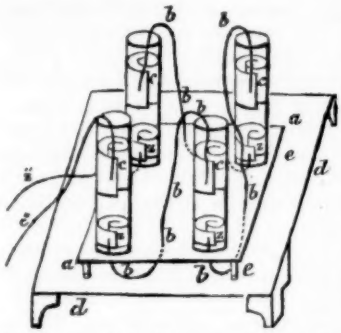
All these numbers were determined, as has been said, by means of a glass fibre, twisted by a Lebailly galvanometer. In the course of these experiments, I had frequent occasion to observe several very perplexing facts, such as a rapid decomposition of water by the polar wires, when after pouring out the solution of salt and sulphuric acid, the tube was filled entirely with a dilute solution of the latter, and yet the galvanometer needle scarcely moved. Again, when there was an extensive movement of the needles, no decomposition ensued. It is a true remark, that the galvanometer needle is no measurer of the decomposing power of a battery. On one occasion, the fluids being nitric acid diluted, and a saturated solution of carbonate of soda, the decomposition of a drop of dilute sulphuric acid, placed between the polar wires, exceeded any thing of the kind I have ever been witness to, and approached, in the opinion of those who saw it, the action of a battery of twenty-three pairs of two inch plates.

By using proper precautions, I have succeeded in decomposing acidulated water, by means of a common arrangement of sulphuric acid in a plate of zinc one-tenth of a square inch, and a plate of copper rather more than double that size. The same plates arranged with four elements, decomposed it with much rapidity.

TABLE IV.—*Respecting the metals.*

2 plates of platinum, with polar wires of the same,	8		1 of copper, 1 of iron,	cop. pole wires.	197
2 plates of copper, with polar wires of the same,	87		1 of copper, 1 of tin,	do. do.	180
1 plate copper 1 " zinc	cop. pol. wir's	222	1 of copper, 1 of lead,	do. do.	184

It appears, therefore, that zinc and copper are the most suitable metals of those yet tried. The action of two plates of copper is singular, but might have been predicted; that of two plates of platinum is unaccountable. If there be no electricity developed, by the chemical action of these liquids on that metal, there is no known reason why a current should pass from them, during infiltration, to one plate rather than the other. It is to be presumed, therefore, that in this case, there was some difference in the surface of the platinum plates, which altered their power of conductibility; they were, however, cut from the same piece of foil. In the case of copper and zinc, the the maximum effect took place, when the copper had four times the surface of the zinc,—in the case of the common battery, it takes place when the surfaces are 7.25 to 1.



It now remains to exhibit the most eligible construction of the battery of four elements, according to these data.

The figure represents a battery of four pairs of plates, coiled into spiral cylinders, half an inch in diameter, and an inch high for the copper, but only one-quarter of an inch high for the zinc plate. The glass tubes in which these plates are to be arranged, are firmly imbedded at one end in a piece of wood, (*a a*,) which is thickly coated all over with sealing wax, that serves both to imbed the tubes immovably, and to insulate them thoroughly. To each zinc plate, a copper wire (*b b*,) is soldered, which, when the zinc is placed at the bottom of a glass tube, passes water-tight through the waxed wood, and is bent upwards as at *b b b b;* it communicates with the copper in the next tube, by a soundly soldered joint. In this manner all the copper and zinc pieces are connected together by wires, one end of the wire being soldered to the zinc plate, in the bottom of the tube, and the other end to the copper in the top of the next tube. The first copper and the last zinc, are to be joined together by a wire much longer than any other, (about eighteen inches,) and when the battery is finished, this wire is to be cut in two in the middle, and the two loose extremities, *c'' z''*, serve as poles.

The copper plates are to be lowered into the glass tubes, (which should be rather more than sufficiently large to receive them,) until they reach within one-sixteenth of an inch of the upper edge of the zinc plates. The piece of waxed wood is then to have four glass pillars (*e e e*,) fixed to its corners. These will support it on a suitable mahogany stand, *d d*.

When the battery is to be used, a solution of salt, nearly saturated, is to be poured into each tube, until it reaches the lower edge of the copper. The remainder of the tube is to be filled with dilute sulphuric acid, of less specific gravity.

A battery of four such plates, is equal to the decomposition of water with great rapidity. It will perform Davy's experiments of the transfer of chemical substances. A visible spark is emitted from charcoal points, and the end of a sewing needle may be made red hot, so as to blue the steel for some distance.

I have constructed a battery of forty-two such plates, which gave the following results: immediately after charging the battery, on moistening the fingers, and touching the polar wires, a very unpleasant shock was received, which passed across the breast. A fine iron wire, lowered on the surface of some mercury, caught fire, and was burnt. The reduction of potash, and all kinds of chemical decompositions, were made with much energy, and mercury was raised in a capillary tube one-eighth of an inch.

The following are some empirical remarks on electrical decomposition,* which may be serviceable to those who make such experiments: they are not rigidly exact, but are useful.

Processes of metallic reduction, by the galvanic battery, are usually conducted in one of these three modes: 1st, the substance to be decomposed is presented in solution with water, as in the case of sulphate of copper, or nitrate of silver: 2nd, it is only moistened with that fluid, as when potassa is acted upon: 3d, it is presented in a liquid form, by the assistance of heat, as in Davy's experiment with the carbonate of lithia.

At temperatures between 40° and 128° Fahr., compound substances, not containing oxygen as one of their elements, are non-conductors of galvanic electricity.

At these temperatures, all the simple bodies are either very good or very bad conductors, and in general, the greater the number of substances existing together in one chemical compound, the more readily is that compound decomposed. Usually, there is no action on solids.

When metallic salts are presented to the galvanic battery for decomposition, in solution with an excess of water, if the power of the battery be in proportion to the strength of the solution, no hydrogen gas is given out at the negative pole, provided the revived metal can exist in water, as copper, silver, &c. If it cannot exist in water, then so soon as an equivalent of it is revived, decomposition of the water ensues, and hydrogen is liberated,—this happens with such metals as potassium and sodium. That a real decomposition of the oxide has happened, is evident by electrifying mercury in contact with a solution of muriate of soda; chlorine is evolved from one pole, and the hydrogen with which it was before united, forms water with the oxygen of the sodium. In this case, the mercury acts as a kind of endless valve, for from the intense affinity which it possesses for the sodium, it instantly allows it to penetrate and be diffused through every part of it; but by excluding the water of the solution, no reaction can take place on the sodium, save only on that which exists nearly at the surface of the amalgam. Between the extremes of good and bad conductors, there is a class of metals, which, in a very comminuted state, decompose water at common temperatures, although they cannot effect it when in mass—as manganese and iron. From solutions, no metals can be revived by the battery, which is not reducible by means of hydrogen gas, below a red heat; and in all these cases, this view may in general be taken, that the electrical decomposition of an oxide, is in reality produced by nascent hydrogen. If peroxide of iron be exposed to a current of hydrogen, at very low temperatures, decomposition ensues, water is formed, and a black cinerous substance is left, which, although it is a non-conductor, is pure iron. In this state, iron will sometimes inflame at temperatures below 100° Fahr. Now the same happens when a saturated solution of proto-sulphate of iron is decomposed by electricity. We may suppose that the hydrogen which would be liberated from the negative pole, whilst its equivalent of oxygen is liberated

* Our correspondent has not even yet seen the results developed recently by Mr. Faraday.—Com. Pub.

from the positive pole, is entirely employed in reducing the protoxide of iron, and the more violent the galvanic action, the more comminuted will be the metallic matter produced, and in this form, even at low temperatures, iron has the power of decomposing water.

When the substance to be decomposed is merely moistened with water, we still bring the reducing agency of hydrogen into play. Hydrate of potassa is a non-conductor, but when a new compound of it is formed with water, that compound is not only a conductor of electricity, but is more readily decomposed. The first point is to dissolve the surface of the hydrate in the smallest possible quantity of water, so as to give it a conducting power; the action produced by the apparatus melts the hydrate; an equivalent of oxygen is given off from the water, and the corresponding equivalent of hydrogen unites with the oxygen of the potash, the metal being revived. The case is exactly the same, when hydrate of potash is decomposed by iron in a gun barrel. At a white heat, the iron unites with the oxygen of the water of the hydrate, and the nascent hydrogen at these temperatures, separates the oxygen from the potassium, the water thus produced being simultaneously decomposed by the iron. The facility of this decomposition, is doubtless owing very much to the volatility of potassium, and the fixity of the oxide of iron, but we may be certain that hydrogen is the main cause of it, for oxide of potassium is decomposed in like manner at a white heat. Gay Lussac has shown, that the reason hydrogen will not decompose hydrate of potash, is owing to the water of the hydrate, which must be decomposed, before any action on the oxide can be produced.

At temperatures between 40° and 120° Fahr., no decomposition can be effected by the voltaic battery, if hydrogen gas is not presented in a nascent state, and as at these same temperatures no compound substance is a conductor, which does not contain oxygen, water must always be present in all galvanic arrangements for decomposition, at those temperatures. But at upwards of 300° Fahr. we meet with many fluids of such conducting power, that without the presence either of hydrogen or oxygen, the mere power of the battery suffices for their complete decomposition, as is the case with liquid iodide of potassium, and chloride of sodium.

Every experiment of reduction, which is effected by the galvanic battery, at temperatures from 40° to 120° Fahr., may be likewise performed by chemical agency, when hydrogen gas is employed, and evolved under similar circumstances, provided the temperature be higher than a red heat.

In these remarks, I would be understood to speak only of common batteries, as, for instance, of forty or sixty pairs of three inch plates. In the case of larger batteries, there is a considerable difference.

Chemical analysis of the Native Chloride of Carbon, a singular mineral. By John W. Draper, *Christiansville, Mecklenburg county, Virginia.*

The changes that take place in the living body, are so much con-

trolled by the operation of the vital principle, that it is very difficult to account for the production of many substances, which, from their uniformity of composition, are evidently the results of a continued disturbing action, upon the usual play of chemical affinity. It is only after death, that the uncontrolled action of the particles of different matter takes place, in a more simple form, and yet when we are even able to set aside the forces exerted by the vital principle, so prone are the elements which enter into the composition of vegetables and animals, to enter into unexpected modes of union, that we often find them assuming complex forms, when they ought, by following the usual laws of chemistry, to put on such as are more simple.

These remarks are very applicable to the substance, whose analysis forms the subject of this paper. I found, during an excursion to Sheerness, Kent, (England) in the summer of 1832, a white efflorescence on the surface of a septaria, on the beach of the Island of Shepey. The coast of this island looking towards the north, is very precipitous, but owing to land springs, and the nature of the soil, frequent slides take place. Whole acres slip down at once into the sea, and their debris extending a long way beyond low water mark, makes the beach shelve very gradually to seaward. These slides usually uncover large masses of septaria, which are used in the dock-yard as a cement. It was on the surface of one of these, that this efflorescence was found. The greater part of it is, at present, in the possession of Dr. Turner, Professor of Chemistry in the University of London.

At the time of collecting this substance, the weather was very fine, and the sky unclouded; there had been no rain for some time. At first, I mistook it for nitrate of potash, but on closer examination found it could not be that substance. It was of a pure white colour, and, like spermaceti, slightly agglutinated when a little of it was pressed between the fingers. It had a faint, disagreeable odour, like decaying fish, was of a light, feathery appearance, like snow. On examining it with more attention, I concluded that the form of the crystal must be a four sided prism, and from that circumstance, that it could not be nitrate of potash.

Not having an opportunity to examine the small sample I had gathered, until some weeks after, I found, that during the time it had been laid aside, it had contracted much in bulk; this might have arisen either from chemical changes, or from its mechanical property of agglutination; the fishy scent was gone, but the substance was still faintly odorous. My first object was to determine whether it was nitrate of potash, whose crystalline form was affected by the presence of extraneous substances; for this purpose, I exposed it to a test, which I commonly use to detect a very minute crystal of that salt, viz. by laying it on a small bit of paper, and setting fire to the end of the paper—as soon as the flame reaches the crystal, a slight deflagration ensues. I was much surprised to find that the substance itself caught fire, and whilst burning, evolved large quantities of carbon.

Subsequent experiments showed, that this substance burnt entirely away, with evolution of much carbon, leaving no residue. Litmus paper, held in the flame, was strongly reddened. To ascertain the nature of the acid evolved, a portion of the substance was burnt under a glass, whose sides were moistened with water. Nitrate of silver discovered the presence of muriatic acid, in the liquid. I now perceived, that the substance was a chloride of carbon, and therefore entered into a more detailed examination of its nature and properties.

This substance is of a whitish aspect, and feels much like spermaceti; it smells faintly, and is lighter than water; it sinks in ether, its specific gravity being about 950. It is insoluble in water, but soluble in four times its weight of ether at sixty degrees, Fahr. Boiling ether takes up a larger quantity, but deposits it again on cooling. It is a non-conductor of electricity—fuses at 235° Fahr., and may be distilled without change—at lower temperatures it slowly volatizes, and may be sublimed from a water bath, in beautiful feathery crystals. It is soluble in alcohol, and hot volatile oils. It burns with a yellow flame, fringed at the upper part with red, and the lower with green.

Sulphuric acid has no effect in the cold, but with the aid of heat, the mixture becomes black, and much sulphurous gas is given out.

When sulphur or phosphorous is fused with this substance, chlorides of those bodies are formed, and carbon deposited, of a shining metallic aspect. Potassium takes fire when heated along with it, forming chloride of potassium, and carbon is deposited. In one instance, this action was so energetic, that the glass tube in which it was performed, burst, and was separated from the other apparatus, with a loud detonation.

I passed the vapour through a red hot tube, and found that muriatic acid gas was disengaged, and carbon deposited. From this I was at first inclined to infer the existence of hydrogen in the compound, and therefore attempted to gain more certain intelligence on that point. On fusing sulphur along with this substance, a moderate quantity of sulphuretted hydrogen was detected; and by the action of sodium, a still larger quantity of pure hydrogen was produced. But, on passing the vapour over peroxide of copper, chloride of that metal, and carbonic acid, were the sole products, from which I infer, that if hydrogen does exist in this substance, it is as an impurity.

Iron, tin, and zinc, at a red heat, decompose this substance; chlorides being formed, and carbon deposited. Peroxide of mercury is changed into calomel, carbonic acid given off, and carbon deposited. From these experiments, I suppose, that setting aside the existence of hydrogen in the compound, which is most likely extraneous, this substance is composed of:—

Carbon, . .	2 atoms,
Chlorine, . .	1 atom.

Of the non-existence of hydrogen, I would not, however, speak decisively, for the whole weight of the substance submitted to analysis, was much less than ten grains. The weight of what was collected at first, might be about 200 grains.

The production of this substance, to judge by its scent at first, and the locality in which it was found, seems to be referable to a marine animal. But through what singular changes must a dead fish pass, before its remains would leave a chloride of carbon, nearly pure.

On the present state of the Science of the Tides. *By the Rev.* W. Whewell, *Fellow and Tutor of Trinity College, Cambridge.*

(*Continued from page* 231.)

DIRECTIONS FOR TIDE OBSERVATIONS.

THE ESTABLISHMENT OF THE PLACE.

The interval at which high water follows the moon's meridian passage, or transit, at a given place, varies from day to day, (being affected by the semi-menstrual inequality.)

The *Vulgar Establishment* is the duration of this interval on the day of new or full moon.

The *Corrected Establishment* is the mean duration of this interval.

The "establishment" of any place is usually said to be the hour of high water on the day of new, or of full moon. The time of high water at London Bridge on September 28, (which was full moon,) was about two o'clock. It will be the same, or nearly the same, on every other day of new or full moon. Hence, two hours exactly, or nearly, is the establishment of London Bridge. In the same manner, at any other place, the time of high water falls very nearly at the same time on all the days when the moon is new, or full. At Portsmouth, this time is forty minutes past eleven; at Plymouth, thirty-three minutes past five; and thus, eleven hours and forty minutes is the establishment of Portsmouth, and five hours and thirty-three minutes the establishment of Plymouth.

This hour was called the *establishment* of the place, from an opinion that the differences of the tide hours at different places, depended solely upon the difference of the establishment; so that this hour being established, the whole course of the tides was settled also. This is not exactly true. If it were so, we could use tide tables of London to find the time of high water at Portsmouth, merely adding or subtracting the difference of the establishments of the two places; but in reality, this way of proceeding would lead us into error, as I have already stated.

It is not true, that the differences of tide times at different places, depend *solely* upon the differences of the establishments; they depend upon other differences also, as I shall endeavour to explain hereafter. The establishment may be considered as the starting point from which the tide hours set off every new or full moon; but these hours differ, not only in the point from which they start, but also in the pace at which they proceed; for this is, though in a smaller degree, different for different places.

The establishment is, however, much the most important of the circumstances which influence the tide hours at any place, and, therefore, deserves to be attended to in the first instance.

If we say that the establishment is "the time of high water on the day of new, or of full moon," the reader may naturally ask, *which* high water? since there are two on the same day. Are we to take that of the forenoon or that of the afternoon? On the full moon day of the 28th of September, the tide of London Bridge was at one hour and fifty-nine minutes in the morning, and at two hours and fifteen minutes in the evening. Which of these times is to be selected as the establishment?

The proper reply to this question would be, "*that* time is to be taken which corresponds to the exact moment of the full moon." But this introduces a new difficulty; for neither of the tides happens at the moment of the full moon. The full moon is at seventeen minutes past eleven in the afternoon; and it can rarely happen that the tide should occur at the very instant when the moon is new or full.

The reason why the tide hours of the forenoon and afternoon are different, is, that the tides are principally regulated by the moon, in consequence of which they fall later and later every half day, by about twenty-four minutes on an average, when we refer them to common time, that is, to the time of the *sun* passing the meridian. Hence, this perpetual difference of the hour will disappear, if we refer the tide to the time of the *moon* passing the meridian. Let us do this with respect to the tides above mentioned. The times of the moon's passing the meridian, were the afternoon of September the 27th, at eighteen minutes past eleven, and the morning of the 28th, at thirty-eight minutes past eleven. Thus the morning tide on the 28th (at fifty-nine minutes past one) was two hours and forty-one minutes after the moon's southing; and the afternoon tide of the 28th (at fifteen minutes past two) was two hours and thirty-seven minutes after the moon's northing. The difference is only four minutes. And, at whatever period of the day the tide had occurred, the interval between the moon's passage and the tide would have been the same, within a few minutes.

Hence, we describe the (vulgar) establishment to be "the interval at which high water follows the moon's meridian passage on the day of new, or full moon. And, taking this definition, it is not necessary to specify whether we mean the forenoon or the afternoon tide, because each of the two follows the next preceding southing or northing of the moon, at very nearly the same interval.

When I speak of the moon's northing, I mean her passing the meridian on the north side of the heavens, which will generally take place when she is below the horizon. And the time at which this occurs may easily be calculated when we know the time of the two successive southings between which this northing is intermediate.

This may serve as an explanation of the *vulgar establishment*, as described in the above "memoranda and directions."

The interval at which the tide follows the moon's passage across the meridian continues nearly the same, not only for the two tides of the same day, but also for all the tides of successive days. The tides are mainly governed by the moon; and, though the interval at which they follow the sun's transit, or noon, varies to all the hours

of the day in the course of a fortnight, the interval at which they follow the moon's transit is only altered at the same place by about two hours at the most.

Thus, in the course of fifteen successive days, the intervals of the tide and the moon's transit are as follows:—

	h. m.			h. m.	
Sept.	28, 2 41	morning tide	Oct.	6, 0 20	afternoon tide
	29, 2 36			7, 0 50	
	30, 2 21			8, 1 42	
Oct.	1, 2 4			9, 2 12	
	2, 1 48			10, 2 21	
	3, 1 7			11, 2 18	
	4, 0 43	afternoon tide.		12, 2 9	
	5, 0 29				

And this interval will go on alternately decreasing and increasing for seven or eight days each way.

Now, this interval on the day of new, or of full moon is, as has been stated, the vulgar establishment; and if all the intervals were equal, the establishment might be got from the observation of the tide on any one day. But, in consequence of the continual increase and decrease of the intervals which has been mentioned, a correction is required in this way of obtaining the establishment, namely, the correction for the half monthly, or semimenstrual inequality, which will hereafter be explained.

Since the interval of tide time and moon's transit goes through all its changes in half a month, as has been mentioned, if we take the *mean* of such intervals for half a month, we shall have an interval which is independent of these half monthly changes. This mean interval will differ, by a small quantity, from the vulgar establishment; but, as it is independent of the half monthly inequality, which the vulgar establishment is not, I have called it the *corrected establishment*.

Thus, the mean of all the above intervals is one hour aud forty-seven minutes, which is the corrected establishment, while the vulgar establishment, as collected from these observations, is two hours and forty-one minutes. The corrected establishment is always less than the vulgar establishment, for reasons which will appear hereafter.

THE SEMIMENSTRUAL INEQUALITY.

It has already been said, that the time of high water is regulated mainly by the time of the moon's transit or southing. The establishment is the interval of time by which the tide follows the moment of the moon's southing, on the day of new or of full moon; and the interval at which the tide follows the moon's southing every other day, is *not very much* different from this. It may, however, be different to the amount of above an hour, and we have now to speak of this difference.

If at any port, for instance at London, we take the interval

which elapses between the moon's southing and the time of high water, on every day from new to full moon, we shall have the following succession:—

Moon's Age.	Tide after Moon's Transit.	Time of Moon's Transit.	Tide after Moon's Transit.
Days.	h. m.	Hours.	h. m.
1	1 57	0	1 57
2	1 45	1	1 42
3	1 32	2	1 26
4	1 19	3	1 11
5	1 6	4	0 56
6	0 54	5	0 45
7	0 46	6	0 42
8	0 43	7	0 52
9	0 45	8	1 23
10	1 1	9	1 56
11	1 27	10	2 10
12	1 57	11	2 8
13	2 8		
14	2 10		
15	2 4		

We see, in the second column, that these intervals are unequal; but after half a month, (from new to full moon, or the reverse,) we come back to the original interval; and if we were to go on further to the sixteenth, seventeenth, and succeeding days of the moon's age, for instance, that is to the full moon, and second, third, and succeeding days from the full moon, we should have a recurrence of nearly the same intervals which we had on the day of new moon, and on the first, second, and succeeding days from the new moon.

In the above table, along with the intervals corresponding to the moon's age in days, I have placed the intervals corresponding to the hours of the moon's transit, or southing. In fact, by stating the hour of the moon's transit, we determine her age, and determine it much more accurately than by saying she is so many *days old*. For, if we say the moon is three days old, (or that it is the third day of the moon's age,) this *may* mean any period of a lunation which is more than two, and less than four days from the new moon; and it will be nearer to the one or the other of these limits, according as the new moon took place at a late or at an early period of that twenty-four hours which we call the first day of the moon. Therefore, when we only know that the moon's age is three days, we only know that the interval of the moon's transit and high water at London ought to be less than one hour and forty-five minutes, and greater than one hour and nineteen minutes. But if the moon pass the meridian at two o'clock, solar time, we know that she must be exactly thirty degrees of hour angle from the sun, and, therefore, that the interval of tran-

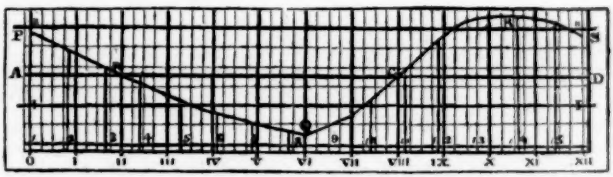
sit and tide should be exactly one hour and twenty-six minutes.* And the same reasoning applies every day, because the moon is, on every day of the month, at a different angular distance from the sun, and passes the meridian at a different hour of the twenty-four. And, therefore, though it is a very inaccurate way of describing the moon's age to say she is so many days old; it is a very accurate way, to say she makes her transit at such an hour.

This way of marking the stage of the lunation, or semi-lunation, of which we have to speak, I shall adopt in future; and I recommend it to naval men, and to all persons who have to take into account the age of the moon, in cases where any sort of accuracy is required.

This being understood, I proceed to make some remarks on the inequality of the intervals of time between high water and the moon's transit; and for the reasons just stated, I shall take the second part of the above table, in which these intervals are referred to the corresponding hours of transit.

1. The inequality of the intervals goes through all its changes, or completes its *cycle*, in a half revolution of the moon, (in the passage from new to full moon, for instance;) it is hence called the *semimenstrual*, or half monthly *inequality*.

2. The change of the interval will be more easily comprehended, if the changing magnitude is expressed by spaces which can be looked at by the eye at one time.



Let a base line be taken, as 0 I. II. III. IV. V. VI. VII. VIII. IX. X. XI. XII. in the figure, and this being divided into twelve equal parts, let lines be drawn perpendicular to it, through all the points of division. Such lines are called *ordinates*. Let there be measured on these ordinates, from the base line, distances representing the twelve intervals in the last column of the above table; and let a curve line, as PBQCRS, be drawn through the extremities of all these measured lines: this curve line is the *curve of the semimenstrual inequality*.

3. This curve has, for all ports for which sufficient tide observations have hitherto been obtained, the same general figure. It has a *minimum* and *maximum*, or least and greatest ordinate, as at Q and R; or, as it may be otherwise expressed, it resembles the letter S laid along the line. If we proceed from the new (or full) moon, its height first diminishes, then increases, and then diminishes again.

4. If a line be drawn parallel to the base line, at a distance equal

* In the whole of this section I leave out of consideration all inequalities except the semimenstrual; as those arising from declination, &c.

to the *mean* ordinate, the curve of the semimenstrual inequality will be *symmetrical* with respect to this line; and this line is called an *axis* to the curve.

Thus, the line ABCD, which is drawn at a distance from the base line representing one hour and twenty-six minutes, is an axis to the curve. It cuts the curve in the points B and C, and the parts before and after the point B are exactly similar above and below the line; and also the parts before and after the point C.

This mean ordinate represents, for any place, what I have called the *corrected establishment;* which is what Laplace has called the *fundamental hour* of the port. The *vulgar establishment* is represented by the ordinate at the beginning of the curve, on the first day of the moon's age, or when the time of the moon's transit is 0.

5. Though the curve is symmetrical on the two sides of the line AD, it is not symmetrical with regard to the two ends of that line. The distance BC is exactly half of AD, but the curve makes a smaller angle with the axis at B than it does at C.

This circumstance in the form of the curve corresponds to this fact; namely, that the intervals (of moon's transit and high water) increase more rapidly after their minimum than they decrease before it. They diminish from two hours and ten minutes to forty-three minutes in nine days, and increase again from forty-three minutes to two hours and ten minutes in six days.

This fact is hitherto found to be true, by experience, at all the places for which we have sufficient observations: it also agrees with the consequences of the theory. It will be seen in the form of the curves for London, Sheerness, Portsmouth, Plymouth, and Brest, if figures like the annexed be drawn for those places.

6. Since we know the effect of the semimenstrual inequality, we can correct for it; and thus, from a tide observed at any period of a lunation, deduce the establishment.

Thus, if at Sheerness, when the moon's transit was at two hours, the high water was at two hours and nine minutes, if we suppose the semimenstrual inequality to be the same as it is at London, we should reason thus:—The semimenstrual inequality makes the interval less by thirty-one minutes, when the moon's transit is at two hours, than when the transit is at 0 hours; (see the above table.) But in this case, the transit being at two hours, the interval is 0 hours and nine minutes. Therefore, when the transit is at 0 hours, the interval will be forty minutes; and 0 hours and forty minutes is the vulgar establishment of Sheerness.

This assumption, that the semimenstrual inequality is the same at all places for the same age of the moon, is not exact, in consequence of the difference of what I have called the *age of the tide.*

7. The intervals between the tide hours on successive days are unequal, in consequence of the semimenstrual inequality. These intervals are least when the tide is greatest, (at spring tides,) and greatest when the tide is least, (at neap tides.)

This will appear from the above table; for since the semi-lunation

is fifteen days nearly, (fourteen three-quarters more nearly,) the moon's time of transit, which increases by twelve hours in these fifteen days, will increase by forty-eight minutes, nearly, each day. We shall therefore have the following times of high water on each day, by finding the time of the moon's transit by the successive addition of forty-eight minutes each day, and the time of high water by adding to this the interval at which the tide follows the moon's transit.

I neglect here the difference between thirty days and an exact lunation; and I neglect likewise the inequalities of the moon's motion; for these enter into another part of the subject. I suppose also the new moon to occur at noon on the first day.

Moon's Age.	Time of Moon's Transit.	Tide after Moon's Transit.	Time of High Water.	Difference.
Day.	h. m.	h. m.	h. m.	h. m.
1	0 0	1 57	1 57	0 36
2	0 48	1 45	2 33	0 35
3	1 36	1 32	3 8	0 35
4	2 24	1 19	3 43	0 35
5	3 12	1 6	4 18	0 36
6	4 0	0 54	4 54	0 40
7	4 48	0 46	5 34	0 45
8	5 36	0 43	6 19	0 50
9	6 24	0 45	7 9	1 4
10	7 12	1 1	8 13	1 14
11	8 0	1 27	9 27	1 18
12	8 48	1 57	10 45	0 59
13	9 36	2 8	11 44	0 0
14	10 24	2 10	12 34	0 42
15	11 12	2 4	13 16	0 41
16	12 0	1 57	13 57	

It appears from the last column of this table, that the time of high water on successive days is, at springs, later by only thirty-five minutes each day; while at neap tides it is later by seventy-eight minutes, or more than double the former interval.

Nearly the same rule would be proved to hold at any other place.

This agrees also with the theory: according to which, the daily retardation of the tides at springs and at neaps, respectively, should be in the proportion of the sum of the lunar and solar tides to the difference of the same tides; where, by the lunar tide, I mean the tide which the moon would produce if the sun were not there; and, by the solar tide, the tide which the sun alone would produce. Hence, the lunar and solar tides are in the proportion of fifty-six and a half, to twenty-one and a half, or of five to two nearly.

The same rule would hold for the retardation of the tides from one *half* day to another, except in so far as it might be modified by the effect of the *diurnal difference of the tides.*

THE AGE OF THE TIDE.

The *circumstances* of each tide do not correspond to the places of the Sun and Moon at the time of that tide, but at a time one, two, or three days earlier; this distance of time is called the *Age of the Tide.*

Two such circumstances may be especially noted:

1°. The spring tide, or *highest* high water, is not on the half day of New or of Full Moon, but at a certain tide on some later half day.

2°. The interval of tide and moon's transit has not its *mean* value on the half day of New or of Full Moon, but for a certain tide at some later half day.

The distance of time from the New or the Full Moon to the time when the interval of tide and moon's transit has its mean value, is the *Age of the Tide.*

—

The age of the tide may be thus explained:

1. The mean ordinate of the curve of the semimenstrual inequality, or the mean interval of the moon's transit and the tide, takes place, at London, at the time when the moon's transit is about two hours, or her age about two days and a half from new or full.

This is also the time when the tides are highest; and since, by the theory, both the mean interval and the highest tides ought to correspond to new and full moon, we may suppose that this mean ordinate *corresponds* to the new and full moon, but that it does not *occur* till two days and a half after that time, in consequence of the length of time which is required to transmit the moon's effect upon the ocean to the port of London.

The length of time required for this purpose I have called the *Age of the Tide.* Mr. Lubbock, following Laplace, calls it the *Retard.*

2. The time which is required to transmit the moon's effect to different places is different. Thus, if we calculate it as we have done for London in the last article, it is a day and a half at Brest, and two days at Sheerness.

It appears also, that the tide hour is later and later at these places in the same order: thus, on the same half day the tide is at 0 hours and twenty-eight minutes at Brest, at nine hours at Sheerness, and at ten hours and nine minutes at London.

We may therefore suppose the tide to *travel* from Brest to London, and that the time of transmitting the moon's effect to each place depends on the time of the tide thus travelling to that place.

On this supposition, the tide would be earlier, and the time in which the effect of full moon reaches it would be smaller, as we go further back in the direction in which the tide hours are earlier. Thus, the tide at the Cape of Good Hope appears to be about twelve hours earlier than at Brest; we should expect, therefore, that the greatest tides, and the mean interval of tide and transit, would, at that place occur only one day after new and full moon, instead of a day and a half, as at Brest, or two days, as at London.

3. But our information with regard to this transit in the phenomena of the tides, is not sufficiently extensive and exact to enable us to reason upon it with confidence and accuracy. A good series of tide observations, continued for a few years, at any place in the southern hemisphere, would, on this account, be of singular value and interest.

4. The effect of the age of the tide upon the curve of the semimenstrual inequality, is not at all to alter the form of the curve itself, but to make the points B C, of intersection with the axis slide further and further from the new and full moon, as the age of the tide is greater. This change is apparent, if we draw the curves for Brest, Sheerness, and London, (as Mr. Lubbock has done in the Philosophical Transactions for 1833,) and then draw their axis.

5. A consequence of the different age of the tide for different places, is, that the tide tables which are good for one place cannot be applied to another, merely by addition or subtraction of certain hours and minutes, at least if much accuracy be wanted. The London and the Liverpool tide tables do not differ on the same day by a constant quantity; and neither of them apply exactly to other places on the coast.

On the Specific Heats of Solids.

On the methods of determining and calculating the specific heats of certain solids, with some precautions to be observed in the experiments. By Walter R. Johnson, *Professor of Mechanics and Natural Philosophy in the Franklin Institute of the State of Pennsylvania.*

The practice which formerly prevailed, of presenting to the public, statements respecting the *results* of philosophical experiments, without an exact detail of the methods adopted for their attainment, and the precautions employed to avoid error, has, in many instances, involved the necessity of *repetitions*, long and laborious, of what ought once for all, to have been definitively settled. The *verification* of a philosophical truth, by a method unlike any previously employed, is a matter entirely different from the processes just referred to; and however well we may be satisfied of a truth, established in one manner, there will always be found both pleasure and profit in attaining the same general conclusions, by methods and considerations independent of each other. There is not, perhaps, a better illustration of this remark, than the variety of methods which may be employed for determining the specific heat of solids. The earliest was that of *mixture*, and consists in immersing the solid, at a known temperature, in water, (or some other liquid,) at a temperature either above or below its own. The temperature lost by the hotter body, and that gained by the cooler, will, with proper corrections, give, when compared, the specific heat of the body under trial.

The next method, that of Lavoisier, employs, instead of the rise

or fall of temperature in water, the latent heat of *water passing from a state of ice;* and the weight of this solid, which any other given solid will melt, while cooling from any known temperature, down to the melting point, is the measure of its specific heat, which, being referred to the quantity of ice which a mass of water, equal to that of the solid, would have melted in cooling the same number of *degrees*, gives us the numerical expression of the specific heat of the solid.

The *third method* employs the cooling power of air, and the *times* which will be required to depress the temperatures of the different solids through a fixed range of the thermometric scale, are taken as the indices of the specific heat. This is the method employed by Professor Meyer on the woods, and by Professor Leslie and Mr. Dalton, on other bodies.

The *fourth method* employs the heat which becomes latent when water is rapidly converted into vapour at its *boiling point*, by the direct and sole agency of the solid, heated to a known temperature above that point. This method may be successfully employed to determine the latent heat of melting metals, as well as their specific heat, from 212° to their melting points, and also their change of capacity, if any, after they have passed into the liquid state. The weight of boiling water which they will, under different circumstances, convert into vapour, compared with the effect of the same amount of water, conceived to be heated to the same temperature as the solid, gives again the numerical expression of the specific heat.

It is evident, that if this fourth method be adequate to give the specific heat when the temperature is known, it is also competent to give the temperature when the specific heat is known; but in order to remove all doubt as to its applicability to the latter purpose, it is well to ascertain by different and independent methods, the exact index of the specific heat, whether uniform or variable, of the solids which may be employed for this purpose. Among the substances adapted to this end, are pure malleable iron, and pure platina. They are both highly indestructible, when heated without the access of foreign ingredients, such as oxygen, sulphur, carbon, silica, &c. and though the specific heat of the former is represented by some writers as increasing pretty rapidly with the temperature, yet this increase is not by any means in so great a ratio, as that of its dilatations, which other authors have proposed to employ as standards for measuring very high temperatures. As to platina, its specific heat is low, and its increments of rate, both in dilatation and specific heat, are represented as very moderate. I may here remark that the experiments of Dulong and Petit on this subject, appear to have been erroneously stated in one part of their prize memoir, which has doubtless led to the supposition that they discovered no increment of capacity in platina by the elevation of temperature. In their table of the specific heats of the different metals at 100° and 300° centigrade, as originally published in the Annales de Chymie, vol. vii. we find .0355 placed, under both of those temperatures, against *platina*. The same numbers are transferred into every English edition

of works in which I have seen that table, with the single exception of Turner's Chemistry, in which the number is, both for 100° and 300°, .0335. Yet, in a subsequent table of the Memoir, Petit and Dulong have given the indications of thermometers formed of the different metals, on the basis of their specific heats, compared with those of an air thermometer at 300°, and they have put down that of platina at 317.9, which it obviously could not be, if its specific heat were invariable; but supposing that heat to increase from .0335 at 100° cent. to .0355; at 300° the indication ascribed to it would be correct. In a recent edition of Turner's Chemistry, by Dr. F. Bache, of this city, this error has been corrected.

But, to return to the subject of iron, we find in the various works of philosophers, a remarkable discrepancy between their statements of the specific heat of this metal.

The following are among the results obtained by the different individuals whose names are annexed:—

On iron, of specific gravity, 7.876, the specific heat was found	.1260	by Wilcke
On soft bar iron, sp. grav. 7.724,	.1190	Gadolin
On sheet iron,	.1090	Lavoisier
On iron, of what quality not specified,	.1250	Kirwan
do. do.	.1269	Crawford
do. do.	.1450	Irvine
do. do.	.1300	Dalton
On cast iron, abounding in plumbago,	.1240	Gadolin
On white cast iron,	.1320	do.
Iron, (kind not specified) between 32° and 212°, F.	.1098	Petit and Dulong
do. do. between 32° and 392°,	.1150	do.
do. do. 32° and 572°,	.1218	do.
do. do. 32° and 662°,	.1255	do.

The mean of these thirteen numbers, is 1.1236. The wide discrepancies are probably owing to the circumstances under which they respectively operated, and to differences in the metal.

Nor is the disagreement confined to the general result; for while Crawford and Irvine contend that the specific heats of bodies remain constant at all temperatures, Dalton, Dulong, and Petit, maintain that they increase with the increase of temperature. But it seems difficult to reconcile this supposition with another result of theirs, viz: that the specific heat of all bodies is inversely as their atomic weights, unless we could suppose, what is manifestly absurd, that the atomic weight varies with the temperature, or that in different bodies the *rate of increase in specific heat* varies always inversely as the atomic weight. Thus if H were supposed the specific heat of any body, and A its atomic weight, and if dH were the increment of specific heat for a given rise of temperature, then not only must AH = the constant C, but also $A\ (H + dH)$ must $= C'$, and of course $AdH = C''$, in order that another body, having the atomic weight a and a specific heat h, should give $ah = C$, $a\ (h + dh) = C'$, and $adh = C''$. Let us observe how far their table of the

increase of specific heat between 212° and 572° Fahr. will bear out this supposition. The atomic weights are those given by Petit and Dulong themselves, with the exception of those of mercury and antimony, which are derived from Dr. Thompson.

Metals.	Atomic weights.	Petit and Dulong's difference of specific heat between 212° and 572° Fah.	Values of C″ from these data.
Mercury	12.5	.0020	.025000
Antimony	5.5	.0064	.023100
Platinum	11.26	.0020	.022520
Silver	6.75	.0054	.036450
Copper	3.957	.0064	.025280
Iron	3.392	.0120	.040704
Zinc	4.03	.0088	.035464

To attribute the character of "*constant*" to such numbers as are found in the fourth column of this table, would be little satisfactory to any who were not prone to uphold a theory at all hazards. Even the apparent correspondencies between mercury and copper—antimony and platina—silver and zinc—are probably mere accidental coincidences. Iron, on which the authors to whom I have referred, appear to have bestowed most attention, gives a result far removed from all the rest, and nearly double to some of them.

The foregoing considerations, together with the use to be made of the specific heat of iron and platina in generating vapour for pyrometrical measurements, have induced me to attempt a re-examination of certain parts of this subject, and for this purpose, I have taken the method originally adopted by Wilcke and Black, viz: that of immersing the hot metal in cold water, in connexion with the fourth method above described, that of using the latent heat of vapour to ascertain the specific heat when the temperature of the solid is known.

In experiments of this nature, several precautions are to be observed, and a considerable number of sources of error anticipated, against which, if we cannot directly guard, we must provide for them the necessary corrections.

1. *We must attend to the character and condition of the metal*, its freedom from alloys or impurities, its specific gravity, its freedom from foreign matter on the surface, particularly from *vaporizable* matters, which may, by being converted into vapour in passing from the source of heat to the cold water, essentially diminish the temperature; or, if in any considerable quantity, may aid in elevating that of the water, and thus give a result too high. I have been sometimes embarrassed by this source of error. In a series of eight experiments, made by heating in a bath of oil, on a given mass of wrought iron, at a mean temperature of 236° Fahr., the temperature of the room being 76°, and that of the water at commencement, 74°.86 in a glass vessel of known specific heat, containing at every trial the same weight of water, and measuring the temperatures every time by the same ther-

mometers, I obtained as the mean result, .12332,—the lowest being .12131, when the iron was immersed at 192°; and the highest, .12920, when the metal was only 190°.

To ascertain how far this source of error would be obviated by adopting a bath of mercury. I made eight experiments in the same glass vessel, on the same piece of iron, and with all other circumstances corresponding to the former set, except that the temperature of the metal at immersion, was at a mean 323¾ degrees, and of course, the specific heat, according to Dulong and Petit, ought to have come out higher than in the other series; instead of which, it was at a mean of .12217, the lowest being .12119 at 338°, and the highest .12499 at 350°. Here the higher temperature gave the higher result.

2. The second precaution relates to the *condition of the water used in the experiment.* The specific heat of saline solutions and earthy mixtures being different from that of water, care should be taken that only pure water be employed. That which has been recently distilled should be preferred, as it is less likely to be charged with air than that which has been long exposed in open vessels. If any considerable quantity of air contained in the liquid, be suddenly expanded, it may rise to the top and escape, carrying with it the portion of heat which has given it so much enlargement of bulk. This would cause an error *in deficiency.*

3. *The temperature and hygrometric state of the air, in which the experiment is conducted,* require attention. It is obvious, that if we commence the experiment at a temperature below the dew-point of the air, the vessel will be accumulating moisture *before*, and *during*, the experiment, and if it remain but for a short time at the initial temperature before the hot body is immersed, the consequence will be, that the latent heat of the vapour being employed in elevating the temperature of the water, the latter receiving from 1000 to 1200 degrees of heat for every unit of water condensed, will cause an error *in excess.* If, however, the vessel has remained in its cold state for some time, and then received a considerable elevation of temperature from the hot body, the whole exterior of the vessel will act as the wet bulb of a thermometer, and tend to keep the temperature of itself and its contents down to the *evaporating point.* This would cause a serious error *in deficiency.*

Both these errors are obviously to be avoided, by not allowing the temperature of the vessel to sink below the dew-point.

In regard to the relative temperatures of the vessel, and the surrounding air, we must observe, that as the latter part of the process, when the solid and the water are approaching an equilibrium, goes on very slowly, it will be necessary to commence our experiment with the water, nearly as much below the actual temperature of the apartment as the increase of temperature is expected to be, in order to terminate as little as may be above the surrounding air. These two conditions, of beginning above the dew-point, and never ending much above the temperature of the air, can only be complied with

when the air is tolerably dry. Such should, therefore, be the state of weather selected for experiments of this nature.

4. *The construction, magnitude, and specific heat of the thermometer,* used to measure the temperature of the water, is an object of some consequence in the determination of this delicate question. To carry entire accuracy into the subject, it will be necessary to know the separate weights of the materials which compose it, and their several specific heats, and further to allow for an amount of water precisely equivalent to that part of the thermometer which is immersed during the experiment. In obtaining a thermometer for this purpose, I caused the tube to be carefully measured and weighed before the bulb was blown, to ascertain its weight per inch in length; then, knowing the length used to form the bulb, it was easy to ascertain the number of grains of glass *immersed* in any given experiment. By again weighing after the thermometer was filled, the weight of mercury it contained was exactly known, and by weighing the *scale* separately, and knowing its specific heat, the *equivalent in water* was found, answering to any portion of the whole instrument, which may be entered along the scale near the thermometric degrees. The necessity of allowing for a *scale* may, however, be obviated by using a naked bulb thermometer, provided the *range* be sufficient, without including the naked part of the stem. But to attain this end, and at the same time possess the requisite subdivision of degrees, the bulb must be large, or the stem very long. Could we employ a cylindrical metallic containing vessel, fitted up with an apparatus to measure its own longitudinal expansions with perfect accuracy, it would perhaps be the best kind of thermometer for such experiments. The specific heat of mercury, at least within the range where a thermometer for our present purpose would be used, is, according to the four independent determinations of Lavoisier, Kirwan, Crawford, and Dulong, .0327. The specific heat of glass, given by six different philosophers, is at a mean, .18511, that of Irvine being .2000, and that of Kirwan, .1740, as the extremes. By three trials on flint glass, in a manner hereafter to be referred to, I obtained a mean of .17854, which is *less* than the above mean result by .00657, and *more* than that of Dulong and Petit by .00154.

If the scale be of brass, we have its specific heat by the mean result of Wilcke, Crawford, and Dalton's determinations, .11276, but as the conducting power of this metal is high, as well as its rate of expansion, it ought, if possible, to be avoided as a part of the immersed thermometer.

5. *The thermometer which measures the heat of the solid before immersion,* should be faithfully compared with that which is used in the water. Thermometers of extensive range are often found inaccurate from containing minute portions of air. It would, for this reason, be desirable to compare their indications with the fusing points of tin and lead, as well as the boiling point of water and mercury. To be sure of at least two points in the temperature of the hot body, it will be well to place it in an iron vessel containing mercury, immersed in boiling water, for *that* point, and in a bath

of melted tin, immersed in boiling mercury, to get the utmost range of temperature measurable by that liquid. By forming a suitable covering for the bath of mercury, and providing for the exit and condensation of its fumes, we may operate with perfect convenience in the method just described.

6. I have already mentioned the necessity of confining the range of temperature taken by the water during these experiments. If we terminate the experiment but one or two degrees above the actual temperature of the room, the loss by radiation and conduction on one side, will in general be so nearly counteracted by the gain on the other, as to influence very little the actual result. But if we employ too small a vessel, the high temperatures of our solid may give too great an elevation, and then we shall have not only the radiation and conduction of the vessel, but the tension of vapour at the surface of the water; and the latter will be greater or less according to its greater or less distance from the dew-point. The absolute loss may be found by a separate experiment, exposing the vessel and water for some hours to the same temperature as that at which the trial took place, and in an atmosphere having the same hygrometric tension. The weight lost during the longer exposure, compared with its length of time, ought to be proportionate to the loss and time in the other case. The number of grains of vapour, would then be multiplied by its latent heat at the generating temperature, to obtain the absolute effect in cooling the mass from which it rose. This error, like that occasioned by the escape of air, and that by the evaporation of dew from the surface of the vessel, will be *in deficiency*.

7. The nature of the vessel containing the water, its surface, specific heat, and the space it leaves open to the air. It should be of such dimensions as to be completely filled when the thermometer and the body under trial, are immersed in the water. If of metal, its perfect homogeneity is to be ascertained, and if of glass, the specific heat should be separately ascertained.

8. To guard the hot body from loss of heat in passing from the source of heat to the cold water, I make use of a thick sheet iron cylindrical shield, which is kept constantly immersed in the melted metal, with the piece under trial, and conveys it to the very mouth of the water vessel, into which it is lowered by a fine wire or thread, enabling the operator to move it from one part of the vessel to another.

9. The vessel and its contents must be weighed with the greatest attainable accuracy at every trial. No reliance should be placed on the apparent levels of the fluid. Graduated measures are entirely out of the question in trials of this kind. To adjust the weight with readiness, I employ a dropping tube with a fine point, and instead of a piston, use a species of micrometer screw, to force out the liquid, or draw it in at pleasure. Drops weighing one-third of a grain, may be easily obtained by this instrument. The method of *substitution* is adopted in weighing, to avoid all inaccuracy in the beam of the balance.

10. A result is not to be taken as established, until it can be re-

produced at least within the limits of the errors of observation. I feel assured that much of the erroneous matter which has been published on this subject, has arisen from a want of due care and patience in repetion. Before closing these observations, it may be proper to add, that when, in any given experiment, the thermometer which measures the temperature of the water, is withdrawn, to insert the hot body, and afterwards returned to the liquid, it will, under certain circumstances of the air, be found to have changed its indication, the moisture remaining upon its surface, causing it to take the "*evaporating point*" as its stationary position. In this case, it must be noted on again immersing the bulb, and the change it has undergone recorded, and subsequently multiplied by the *equivalent* of the immersed part of the thermometer, to obtain the requisite correction.

The table exhibiting the data, calculations and results of experiments to determine specific heats in the manner above described, will contain the following particulars: 1st, The number of the experiment. 2d, The kind of heating liquid employed. 3d, The dew-point of the apartment. 4th, Its evaporating point. 5th, The weight of solid under trial. 6th, The temperature at which it is immersed. 7th, Temperature of the water. 8th, Temperature of the thermometer when immersed. 9th, Temperature of the air. 10th, Resulting temperature of the water. 11th, Gain of temperature by the water, containing-vessel, and thermometer. 12th, Loss of temperature in the solid. 13th, Time occupied by the experiment. 14th, Weight of water in grains. 15th, Equivalent of the containing-vessel in grains of water. 16th, Equivalent of the part of thermometer immersed. 17th, Sum of the equivalents in water, containing vessel, and thermometer. 18th, Product of the preceding column by the gain of temperature. 19th, Product of the weight of solid by its loss of temperature. 20th, Correction obtained by multiplying the equivalent of the thermometer by its variation from the initial temperature of the water. (This correction will be either positive or negative according as the evaporating point is below or above the the *initial temperature.*) 21st, Specific heat obtained by dividing the 17th column *corrected*, by the 18th. Other corrections may be inserted when necessary, according to the observations already made.

To present the several cases to which we have referred in the preceding remarks, the following formulas may be adopted:

1. When the specific heat of the containing vessel is to be ascertained, by first filling it with water of a known temperature, and letting it stand until we are sure that a stationary point has been attained, then emptying it, and instantly refilling with water of a different temperature; if the expansions of the vessel could be made to measure its own increase or diminution of temperature, we should have the simplest of all possible cases;—for calling

w = the weight of water in grains,
T = the degrees of change in temperature which it undergoes,
g = the weight in grains of the containing vessel,
t = the change of its temperature by the experiment,

and x = the specific heat of the material of which the vessel is composed, that of water being unity, we shall have

$Tw = gtx$ or $x = \frac{Tw}{gt}$ (1.) This supposes the experiment to be made with such regard to the thermometric and hygrometric state of the air, as to require no correction on that account.

2. If we introduce a mercurial thermometer, with a brass scale, to measure the change of temperature, putting

b = the weight of brass immersed,

m = the weight of mercury,

c = the weight of the glass bulb and that part of the stem which sinks into the water, we have, for the equivalent of the thermometer in grains of water, the following expression: .11276 b + .327 m + .18511 c, and since by suspending the thermometer, or otherwise fixing it in a certain position for many experiments, we can always use the same part of its length, we may substitute for this complex term the simple expression e for the thermometrical equivalent in grains of water; then the formula (1) will become $x = \frac{T(w+e)}{gt}$ (2.) It was by this method of trial and calculation that the three experiments before mentioned gave .17854 for the specific heat of glass, though in the expression for the thermometer, I have chosen to use the mean of six other determinations, until I can repeat and vary the experiment, so as to be satisfied which is nearest to the truth.

3. The specific heat of the containing vessel being known, we proceed to that of any other solid, (wrought iron for example,) putting its weight in grains = i, and its specific heat = z. T will now represent the change of temperature, not only of the water and thermometer, but also of the containing-vessel, and t the change of the solid i; g, x, and e being the same as above; then will $itz = T(w + gx + e$ and $z = \frac{T(w + gx + e)}{it}$ (3.) Or the formula, may be simplified by representing the term $w + gx + e$ by W', whence $= \frac{TW'}{it}$ (4.) To this, as before stated, we must apply a correction, if the thermometer be not at the same temperature when immersed, as the water was when the solid was plunged into it. Calling the difference d, we have the correction $\pm de$, as before stated, according as the thermometer was *below* or *above* the water, and hence the formula becomes $z = \frac{TW' \pm de}{it}$ (5.)

4. If the specific heat of the solid under trial, and of the containing vessel g be the same, (as when a vessel of untinned sheet iron is employed to hold the water,) we may, if the specific heat be supposed not to vary within the limits of our experiment, employ the following expressions in which z is the specific heat of both, the solid and the water vessel, T, w, and e remaining as before. We then obtain the equation,

$itz = T(w + e + g z) = T(w + e) + Tg z$, and by transposition,

$$itz - Tgz = T(w + e,) \text{ whence } z = \frac{T(w + e)}{it - g T} \quad (6.)$$

5. But if, instead of making the container of the same material as the body under trial, we choose to form it of any other kind, even of one whose specific heat is not yet known, we may, by using vessels of *different* thicknesses and the *same* liquid content, ascertain, by successive experiments, under otherwise similar circumstances, the specific heat of the material which composes the vessel. Thus two jars, capable of containing the same weight of water, may be formed of glass from the same melting pot, but one possessing two or three times the thickness of the other. We may then heat the same mass of iron twice, (or any number of times) to the same degree, and immerse it in water at the different trials in each of the two vessels at the same temperature, then putting

w = the weight of water contained in each glass,
g = the weight of the thicker glass,
g' = that of the thinner,
x = the unknown specific heat of glass,
T = the change of temperature of water and glass when g is used,
t = the change of temperature of iron when g is used,
T' = the change of temperature of water when g' is used,
t' = do. do. of iron when g' is used,
i as before = the weight of iron,
z = its specific heat,
e = the equivalent of the thermometer.

Then as the temperature of the water, the air, and the iron, are supposed to be the same in both cases, we shall have by (5) the two expressions,

$$1.\ z = \frac{TW' \pm de}{it} = \frac{T(w + e + gx) \pm de}{it}$$

$$\text{and } 2.\ z = \frac{T'W' \pm de}{it'} = \frac{T'(w + e + g'x) \pm de}{it'}$$

from which we derive,

$$3.\ \frac{T(w + e) + Tgx \pm de}{t} = \frac{T'(w + e) + T'g'x \pm de}{t'}$$

Hence

$$4.\ Tt'(w + e) + Tt'gx + t'de = T't(w + e) + T'tg'x \pm t\,de.$$

And by transposition, (supposing de the same in both cases,)

$$5.\ Tt'gx - T't\,g'x = (T't - Tt') \cdot (w + e) \pm (t \mp t')\,de$$

And by division,

$$6.\ x = \frac{(T't - Tt') \cdot (w + e) \pm (t \mp t')\,de}{Tt'g - T't\,g'};$$ which, if there be no correction for thermometric variation, will be reduced to the simpler form,

7. $x = \frac{(T't - Tt') \cdot (w + e)}{Tt'g - T't g'}$ (7.) And as the value of x is now found, we may substitute it in either the first or second equation, to find the value of z. The first would give, (omitting the correction, $\pm de$,)

8. $$z = \frac{T(w + e) + Tg\left(\frac{(T't - Tt') \cdot (w + e)}{Tt'g - T't g'}\right)}{ti.}$$

or, 9. $$z = \frac{TT'(g - g') \cdot (w + e)}{i(Tt'g - T't g')}.$$

The necessity of applying the correction $\pm de$, arises from the liability of the warm current of liquid ascending from the hot metal to elevate the temperature of the thermometer above that which ought to be exhibited by the liquid when the maximum effect of the solid has been attained. By taking the thermometer out of the water at the instant the metal is immersed, and keeping it out till near the conclusion of the experiment, we not only have a better opportunity to agitate the liquid, but also avoid the deception just referred to.

If the experiment be commenced precisely at the *evaporating point*, the bulb of the thermometer, covered with a film of water, will be retained at that point, and no correction required.

6. The formula for the fourth method of determining specific heats which may serve as a *verification* of the one just presented, is founded on the fact that the *weight of vapour* generated by a given weight of metal, is proportionate to the *weight*, *temperature*, and *specific heat* of the metal employed.

The experiments in this case all terminate at the boiling point, but may commence at any known *superior* temperature. The result obtained will, therefore, be the mean specific heat between the temperature of boiling water, and that at which the metal enters the liquid.

Calling i = the weight of metal employed;
t = its temperature above boiling point at immersion;
and z = its mean specific heat from boiling point to the temperature at which it is immersed;
also v = the weight of vapour produced by the action of i;
and l = the latent heat of vapour from water boiling in the open air at the time and place of the experiment:

Then, by the above statement, we have (supposing no heat lost by any other means than vapourization,) the *effect* $= vl$; and the *cause* $= itz$. The latter is on the supposition that the experiment ceases, and the loss of weight in water is ascertained the moment the metal has come down to the boiling point. Hence $itz = vl$, and $z = \frac{vl}{it}$.

Also as above stated, the temperature t can be found when z is known, thus, $t = \frac{vl}{iz}$.

Numerous experiments on several branches of the subject, have already been made, and others are in progress, the whole of which will, in due time, be laid before the public.

FRANKLIN INSTITUTE.

Committee on Science and the Arts.

REPORT ON MR. PECK'S METHOD OF PROPELLING BOATS.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination a Plan of Propelling Boats, invented by Mr. J. Peck, of Oakland, Jefferson County, Tennessee.

REPORT:—

That the inventor proposes to employ what he terms a *multiplied crank*, attached to an axis made to revolve horizontally by some power not indicated in the sketch before us. The several wrists of the compound crank are to have either setting poles or hooks attached, one to each wrist, which poles or hooks are to act successively in urging the boat forward, by applying, when poles are used, to the bottom of the canal, or stream, and, when hooks are substituted, to a rack or rope, extending the whole way on the shore. Coiled springs are to be placed in some part of each pole, to prevent the effect of sudden and violent impulses. When the pole is used to apply to the bottom, a species of foot, made of three or four strips of metal, attached by hinges to the lower end of the pole, are to spread out and present a large surface to the soft bottom of the stream, to avoid sinking deep into the mud.

The slight sketch in the hands of the committee does not show any provision for guiding and directing the poles, nor obviate the difficulty from unequal depths on the two sides of the boat, when poles are used on both sides.

The method appears less suited to a rail-way than the rack-rail already in use, in connexion with toothed wheels, to insure the advancement of locomotive engines.

It seems unlikely that this plan will supersede the more simple methods already used for propelling boats, unless under very peculiar circumstances, and with some arrangements for obviating the practical difficulties which are not indicated in the sketch before us.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

March 13, 1834.

REPORT ON MR. B. DUGDALE'S WIND-MILL.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination a Horizontal Wind-mill, invented by Mr. B. Dugdale, of Burlington, N. J., REPORT:—

That the machine in question consists of an upright shaft revolving on a pivot in a step at its lower end; from which shaft, near its upper extremity, proceed, in one horizontal plane, ten equidistant arms; and from near the middle of the same shaft, proceed ten corresponding arms, also in one horizontal plane. Between each pair of corresponding arms, oblong rectangular frames of wire are hung, (at the extremities of the arms,) in such a manner as to admit of a horizontal vibration, through an arc of about ninety degrees. To these frames the sails are attached by small rings of wire, which can slide up and down the vertical bars of the frames.

The operation of raising the sails is performed by means of cords, one of which is attached to the stretcher at the upper end of each sail, and passes through a pulley at the extremity of the upper arm, along that arm to the shaft, and down the shaft to a collar sliding on the same. When this collar, to which all the cords are attached, is depressed on the shaft by means of a lever, all the sails are raised simultaneously. Again, when the collar is elevated, the cords become slack, and the sails drop by their own weight.

The vibratory motion allowed to the frames which support the sails, is so regulated that the sail on one side of the shaft, present their surface to the wind, while those on the opposite side offer their edges only: the efficiency of the machine is due to this arrangement.

Your committee deem it unnecessary to expatiate upon the merits of this wind-mill, or to discuss the patentee's claim to originality in his invention; but will merely refer all who are interested in the subject, to the Repertory of Arts, and to the Edinburgh Encyclopedia, in which they will find described several mills operating upon the same principle; some of which closely resemble this one in the details of their construction.

By order of the Committee.

WILLIAM HAMILTON, *Actuary.*

March 13th, 1834.

REPORT ON MR. SMITH'S COMPASS NEEDLE.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination an improved compass needle, manufactured by Mr. —— Smith, of Washington City, REPORT:—

That they have examined the needles submitted to them for that purpose by Mr. Trotter, together with the pamphlet of Mr. Smith, entitled "An Improvement," &c. and the notice of the patent for this improvement in the Journal of the Franklin Institute.

The claims in regard to the needles, appear to be,—

1. To a method of magnetizing them by percussion with what is called an electric rod.

2. To the removal of the influence of irregular magnetic distribution, and of local attraction, by "shifting feeders."

In regard to the particular method used by Mr. Smith, of conferring magnetism by percussion, the committee have no precise information, the needles not having been presented for their examination by the inventor himself, and no adequate description having been published of the details of his method. The general fact is well established in science, and testimony from various quarters speaks well of the application of it by Mr. Smith. Respecting the efficacy of the small pieces of soft iron termed "feeders," shifting upon the magnet, and usually placed near the poles, the committee inquired and refer to the subjoined experiments for the data upon which their opinion has been formed. In these experiments they availed themselves of the kind assistance of Prof. Henry, of Princeton, who was, at the time they were making them, on a visit to our city.

The first object was to ascertain whether the feeders added to the intensity of the magnetic force in the needle.

For this purpose the needle, furnished with its feeders drawn out to the marks on the ends, was suspended by a bundle of fibres of raw silk, free from twist. It was placed over a divided circle that its deviation from the magnetic meridian might be observed. Drawing it out of that meridian, it was made to vibrate, and the vibrations noted, when they had diminished so as to reach a certain extent. The mean of one hundred and twenty vibrations gave for the time of ten vibrations 80.47 seconds.

The weight of the magnet furnished to the committee, was, without the "feeders," 532.1 grains. The feeders weighed together, 13.9 grains.

For these iron "feeders" two pieces of brass, of nearly the same weight and form, were substituted, that the mass of the needle might remain the same; the brass pieces were placed in the position formerly occupied by the feeders, and the needle was then vibrated.

The brass feeders were lighter than the iron ones by .1 grain. From two series of experiments of one hundred and twenty each, the time of performing ten vibrations in this latter case was 79.87 seconds.

By the well known law expressing the relative horizontal intensities of the magnetism in these two cases, viz: that the forces are inversely as the squares of the time of vibration; the intensity in the first case was to that in the second as 79.87^2 to 80.47^2, or as .98 to 1.

The force of the magnet, instead then of being increased by the feeders, is slightly diminished by them. Your committee must observe here, that it seems to them that this result is what should have been expected from placing a piece of soft iron within the poles of the magnet.

The next point to be examined was the efficacy of the "feeders" in preventing the effects of local attraction. This might be inferred

from the results just given, but the committee preferred to subject it to direct experiment.

The same needle before used, was placed upon a steel point, fixed in the centre of a graduated circle. A mass of soft iron was brought to a measured distance from the needle when the "feeders" were on; the deflection produced was noted; the "feeders" being removed, the deflection produced by the same mass in the same position, was ascertained. These experiments the committee did not consider susceptible of the same nicety which was used in the first inquiry. The piece of iron was a rectangular plate, nineteen and three-eighths inches long by six and three-eighths wide, and weighing twenty-four pounds. The following results were obtained, and may be considered to approximate within about one-quarter of a degree of the truth.

When the iron plate was placed with its longest side making an angle of about forty degrees with the axis of the needle, the least distance from the south pole of the needle, six inches,

With the "feeders" on, the deflection was $18\frac{3}{4}°$.
With the brasses on, " $19.°$

The plate was now brought to half the distance above stated.

With the "feeders" on, the deflection was $31\frac{1}{4}°$,
With the brasses on, " $31\frac{3}{4}°$.

The proportional difference in the deflections with the feeders on and off, is, in the first case, one in seventy-six, and in the second, one in about sixty-four. These numbers are to be considered as merely approximate, but they serve to show that the needle is less deflected with the "feeders" on, than when they are off, a result agreeing with the conclusions to be derived from the first experiments, which showed that the magnetism was weakened by the "feeders." If the magnetism had been entirely destroyed, the deflection would have been nothing. The needle subjected to experiment was, in fact, a very weak magnet, and the feeders made it still more feeble.

In the Transactions of the Irish Academy for 1788, a plan is proposed "to preserve the magnetism, and consequently the *polarity*, of the needle," by having it "cased with thin, well polished, soft iron, or else to have it armed at the poles with a bit of soft iron." Capt. O'Brien Drury, by whom this suggestion was made, modestly submits his invention to the judgment of those who are qualified to appreciate its merits, and we conceive that this judgment may be considered to have been formed by the neglect of the invention during the forty-six years which have elapsed since its publication. In the plan before the committee, the needle is not entirely cased, but is furnished with shifting bands of soft iron.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

March 13, 1834.

REPORT ON MR. W. HENDERSON'S CHART OF COMMERCIAL WEIGHTS.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination a Chart of Commercial Weights, submitted by Mr. William Henderson, of Philadelphia, Penn., REPORT:—

That this Chart comprises scales of comparison of the weights of the principal commercial cities of Europe, and other parts of the world.

Scales of the ancient weights of France and Holland, being those most generally referred to in books of science, are also given.

On the left of the scales the names of the countries or cities are printed, and also the denomination of weight into which the scales are divided; as pound, rotoli, kilogrammes, &c.

The divisions on the scales are numbered at every ten.

For facilitating the comparison of weights of different countries, meridional lines are drawn across the scales at convenient distances.

Where different weights are used in the same country, different scales are, for the most part, given; as in the United States of America, one scale is given of pounds troy, and another of pounds avoirdupois. The troy scale extends from 0 to 219 pounds, and the avoirdupois scale, from 0 to 179 pounds; and within this compass, the comparison of weights of different countries is made by taking equal distances on the respective scales, from 0, or from the nearest meridional line, to the weights given and required.

The committee are of opinion that the Chart of Mr. Henderson will be found useful in commercial establishments, but would recommend that the meridional lines should be made to correspond with definite divisions of the avoirdupois scale, as by that arrangement, the comparisons could be made by a simple inspection of the Chart.

By order of the committee.

WILLIAM HAMILTON, *Actuary.*

April 9th, 1834.

AMERICAN PATENTS.

LIST OF AMERICAN PATENTS WHICH ISSUED IN APRIL, 1834.

With Remarks and Exemplifications, by the Editor.

1. For a *Planting Plough:* Benjamin Hussey, Jonesborough, Washington county, Tennessee, April 1.

This machine is intended for dropping corn, or other grain, into ground which has been prepared for it. There are to be two wheels with their axle, and hounds for the draft. These are to sustain a hopper, into which the grain is to be put. A piece of sheet iron, properly perforated, passes along the bottom of the hopper, and this is to be touched by cogs projecting from one of the wheels, which cause it to drop the grain at regular distances, which distances may

be determined by the number of the cogs, &c. A share is so fixed as to cover the grain.

There is no claim made, although it can scarcely be unknown to the patentee that there have been numerous drill ploughs, and seeding machines made, and that some of them resemble the one before us in many particulars.

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2. For a *Machine for Pegging Boots and Shoes;* Nathan A. Fisher, Westborough, Worcester county, Massachusetts, April 3.

The apparatus here patented is intended to cut and drive the pegs into a shoe one at a time, the pegs being made from a strip of wood of the proper length and thickness, and sharpened at its lower edge. A plate of metal, of the form of the sole, is to be fixed thereon, and this plate is to have notches in its edge, like saw teeth, to serve as guides for the pegging awl. The instrument with which the holes are to be made, and the pegs driven, consists, in part, of a hollow tube, like a piece of gun barrel, five or six inches long, into which is fitted a punch, or piston, borne up by a spiral spring, and having on its lower end an awl, and a peg driver, at such distance from each other as the pegs in the shoe are to be placed. Although some pains have been taken to describe the machine, we should be unable to construct one from the description given, even with the aid of the drawing. Perhaps, were we to examine the model, the operation might be made plain. The whole appears to be considered as new, no claim being made to any particular part, nor indeed to the general arrangement of the whole.

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3. For *Promoting the Draft in Chimneys;* Elijah Skinner, Sandwich, Strafford county, New Hampshire, April 3.

In the mason work at the back of a common chimney fireplace, two small apertures, or flues, are to be made, about eight inches apart, and commencing about six or eight inches from the hearth; these are to extend up nearly as high as the mantle, and on the top of the apertures thus formed, two short metallic pipes, of two or three inches diameter, are to be fitted, and on these are to be placed similar pipes, extending up the flue, from two to four feet. Dampers are to be placed in these pipes, to regulate the draft.

The claim is to "the introduction and arragement of said metallic flues and pipes, into the channel of the common chimney, as conductors of heat, in such a manner as to rarify the air in said channel, and produce a stronger draft of smoke with a small quantity of heat taken directly from the fire."

We do not perceive any difference between the effect to be produced by this plan, and that which would result from lessening the flue, which may be done to greater advantage, especially where anthracite is burnt. There is in this city (Washington) a house recently erected, in which the flues of the fireplaces in two contiguous parlours differ very much in size, one of them being of the usual dimensions, the other but seven inches square, or rather less; this latter was so built at the urgent recommendation of the writer; it is

contained within the thickness of the wall, and is found to draw better than the larger one, not the slightest portion of the gas from the anthracite escaping into the room. The bricklayers prophesied that it would not answer, but they were mistaken.

4. For an improvement in *Harrow Teeth:* Perry Prettyman, Georgetown, Sussex county, Delaware, April 3.

The claim made in this patent is to "the peculiar form of the tooth as described; more especially the angle of inclination of the planes of the wings, and of their edges to the shank, the sharp edges formed at their juncture continuing up the shank, and the wings of the fluke being made at right angles to each other or nearly so."

It is probable that the peculiar form described with much minuteness in the specification, may be a very good one, but it is certain that it may be materially departed from, so as to remove it out of the range of the patent, and yet answer the same purpose. There have been so many near approaches to it in the numerous cultivator teeth which have been made, that we think it would be a difficult task, without something more definite, to draw the line at the point where the patent ends, and the public right commences.

5. For a *Truss for Hernia*; Thomas Stagner, Madison county, Kentucky, April 5.

We have in vain looked for a single novel feature in this truss, which is one of the most ordinary kind. The pad is to be of soft wood, and a strap attached to the spring which passes round the body, is to hook on to it; the old fashioned crotch strap is also used to keep it in its place. There is no attempt made to the designating of any part, as new and we have never seen an instance in which such an attempt would end in a more signal failure.

6. For a *Sofa Bedstead;* Francis Breckels, city of New York, April 5.

Sixty or seventy years ago, it was much the fashion to make sofa, or settee, bedsteads; the principal inducement to which, in Europe, was the frequent occupancy of a single floor by a family, rendering it desirable to economize room, as well as to keep up appearances, where every apartment must contain its bedstead. Various attempts have been made to introduce similar articles here, but with little success; those who are in situations which render it desirable to keep up a show of gentility, are seldom so cramped for room as to render it necessary to mask their bedstead under the guise of a sofa, or a bureau; besides which, in a warm climate, teeming with life, it is very desirable that the bedstead should be as simple as possible in its form, or its name will be *legion;* this latter consideration, we feel assured, is sufficient, alone, to put a veto upon the general use of the article under consideration.

The patentee, after describing the manner in which he constructs his sofa, so that it may be unfolded into a bedstead, claims "the improvement of turning over the seat in such a manner as to form the

sacking bottom from the back part of the sofa frame, over and across the bottom of the seat."

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7. For an *Amalgamating Mill, for separating Gold from other Substances;* James Bogardus, city of New York, April 7.

The patentee states that the modes of amalgamation heretofore pursued do not enable the mercury to collect all the particles of gold, more especially in those cases where it is contained in pyrites, but believes that the machine invented by him will effect this object in a perfect manner; it is constructed as follows:—

A plank of six or seven feet in length, eighteen inches in width, and three in thickness, is to have a zig zag, or serpentine, channel sunk on one surface of it, which channel may commence and terminate at the distance of a foot from the ends of the plank; it may be about four inches wide, and sunk to a depth of two inches. This plank is to be made perfectly flat, so that a second, of similar dimensions, may, when bolted on to it, make a water-tight joint, under a certain degree of hydrostatic pressure.

An excavation, to receive two mill plates, is to be made at one end of the above described channel; these mill plates are to "consist of two circular sheets of copper, say one-fourth of an inch thick, and about ten inches in diameter. The excavation is to be made oval, as the two mill plates are not to be concentric; the length of the oval is to exceed its width about one-third. The lower mill plate is to have a pin projecting from the centre of its under side, which passing into a socket formed in the plank, allows it to revolve, and there are to be four or five holes, of about an eighth of an inch in diameter, drilled through this plate, for the free passage of mercury with which the channel is to be nearly filled.

The upper mill plate is to have a circular hole in its centre of an inch or more in diameter, and to this is to be secured a cylindrical tube of twelve or fifteen feet in length, through which the ore, broken into small pieces, and mixed with water, is to pass down between the plates. The lower end of this tube turns in a collar, and it may be driven by a whirl and band at its upper end, where it widens out into the form of a funnel, to receive the ore and water. The tube must be enclosed to nearly its upper end, in a water-tight case, attached to the upper plank.

The principle upon which the grinding plates operate is explained in our notice of a patent obtained by the same gentleman, on the 18th of January, 1832.

The far end of the channel terminates in a small well, or excavation, in the lower plank, above which the upper plank is perforated so as to allow the water, and refuse ore, to rise up by the hydrostatic pressure, and be discharged. This opening may, if necessary, be surrounded by a rim, so as to increase the depth of the well. When in use, this end of the machine is to be elevated a few inches above that in which the mill plates are contained.

"The principle of this invention consists in the combining the principle of said Bogardus' said universal mill with a channel nearly

horizontal, of convenient length, terminating in a well capable of holding a large portion of the mercury which the channel will contain, with a vertical tube over the plates, of a height and capacity capable of containing water sufficient, by its own power, to force its way through the mercury in said channel, the most expedient form of said channel being zig zag, or serpentine, and the most expedient position thereof being that of a slightly elevated or inclined plane, rising from the mill to the well.—Said well having a spout to discharge the water and ore, and other heterogeneous substances, and being elevated as aforesaid, so that the mercury will run back to the mill plates, whenever forced away from them by the power of the water."

We have given more space to this description than we can usually afford, and have been induced so to do from a knowledge of the fact, that a very favourable opinion has been entertained of the eventual success of this apparatus, by persons upon whose judgment some reliance ought to be placed; but it so happens, that although a good general judgment, and a good judgment in mechanics, are certainly not incompatible, still, they are very different things. It frequently falls to our lot to be placed in the situation of Micai, and such is at present the case. We see, or think we see, numerous objections to this machine, so numerous that we cannot here allude to the whole of them; nor indeed can we find space to state either of them fully.

We think the capacity of the machine altogether inadequate to the kind of business it is to perform; a tube of fifteen feet in length, and one inch in diameter, will admit but little ore, and will soon choak. The mill plates of ten inches, would do but little work could the ore be supplied to them, and, as they are to be made of copper, and to revolve in mercury, they will soon disappear, amalgamating therewith, like the gold. The holes through the lower plate, for the passage of mercury, will soon be stopped up, and cease to perform their intended function; and if the two planks can be bolted together, so as not to admit of the passage of mercury between them, we promise, when informed of this fact, to leave off prophesying.

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8. For a *Plough;* John Morford, Maysville, Kentucky, April 8.

We are rarely able to define the improvements made in the plough, as what are so called usually consist in minute changes of form, and in the mode of attaching the respective parts to each other; such is the case in the present instance, and we, therefore, leave a critical examination of it to those who may wish to make further *improvements.*

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9. For a *Printing Press;* Charles F. Voorhies, Newark, New Jersey, April 8.

This printing press is one which manifests much ingenuity in the contrivance of it, but it requires the aid of drawings to make its construction known, and at a period so prolific in improvements upon this important instrument, it appears that what is new to-day, may be superceded by the contrivance of to-morrow. In the art of print-

ing, the revolution has been as entire as in the business of locomotion, and books are produced as men travel upon rail-roads, by steam engines. We would insert the claim made by Mr. Voorhies, if, as is frequently the case, any tolerable idea of the machine could be collected therefrom, but as it refers to the previous description and the accompanying drawings, it would be unavailing.

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10. For an improvement in the *Mode of Steering Vessels;* John B. Holmes, Boston, Massachusetts, April 11.

The description of this improvement is quite brief, being comprised in less than a dozen lines. Upon the rudder head a segment of a spur wheel, about two feet in diameter, is to be secured. A pinion wheel, eight inches in diameter, more or less, is to take into this segment wheel, the shaft upon which the pinion is placed turning in a suitable frame, strongly bolted to the deck. A second wheel, of about two feet in diameter, either spur or bevil gear, according as the steering wheel is to be vertical or horizontal, is to be placed on the same shaft with the pinion. Nothing is said about a second pinion to gear into this second wheel, which is, of course, an accidental omission, as such a one there must be, and indeed it is shown in the drawing.

The claim is to "the above improvement, whether the power be applied by gear wheels, or by metal or other bands, and whether the same be used upon or between decks,—in all cases where two or more shafts are used to form a compound lever."

The same principle has been so frequently applied to steering, that a claim like the foregoing, will be found much too sweeping, more especially as it claims not only what is described, with its modifications, but all possible arrangements where two or more shafts are used.

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11. For a *Printing Press;* William R. Collier, city of Washington, April 11.

This printing press is intended to be worked either as a power or hand press; the description given of it is very full, occupying several sheets of paper, and referring to the drawings throughout. Were we to attempt to epitomize this description so as to convey a clear idea of the construction of the instrument, we must devote more time and space to it than appear to be due, as, according to our impression of its action, it will not rival the presses now in use, either in rapidity of action or accuracy of execution; when we learn that we are mistaken on these points, we will say more about it.

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12. For a *Stove for Cooking and other purposes;* Thomas Whitson, Roxbury, Norfolk county, Massachusetts, April 11.

The specification commences by informing us that "the improvement claimed consists in causing the flame and smoke of the fire to come into contact with the oven, and surround it on every side, and in such a manner as not to obstruct the use of the boilers at the same

time; and in making the grate portable, so that wood, coals, or other fuel, may be equally well used for heating the same."

There are so many stoves whose chief merit is thought to consist in causing the heated current from the fireplace to surround the oven on all sides, that it is a little surprising to find this now claimed as a distinguishing characteristic of a new stove. (See the specification of Harriman's stove, p. 272.) The form of the apparatus, as shown in the drawing, does not differ materially from some which have preceded it, and considering the great variety which have been patented, it is nearly impossible for any one to avoid this kind of collision. If the stove before us is susceptible of defence as a new invention, we think that it could prove so only under a claim to the particular arrangement of its parts, there being little or no novelty in either of its individual features.

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13. For *Preventing the Loss of Lives in the Explosion of Boilers on board Steam Boats;* Timothy Newhall, jr., Lynn, Essex county, Massachusetts, April 12.

This is one of those queer contrivances which are occasionally born of a kink in the understanding, are afterwards nursed until they find their way to the Patent Office, where they rest in peace, and are recollected only from the reading of their *hic jacet.*

That our readers may have all the means which we ourselves possess of forming an accurate judgment upon the subject, we will place before them the whole sum and substance of this contrivance, as nearly as may be in the words of its author.

"The invention consists in having water, or any simple or compound liquid, between the boiler and the quarter deck, and between the boiler and the forward or main deck, and between the boiler and the after cabin, and between the boiler and the forward cabin, and between the boiler and the after hold, and between the boiler and the forward hold." This water is to be enclosed in wood, or other substance, extending from side to side of the boat, and rising seven feet above the deck. There is thus to be two walls of water, dividing the boat into three parts. The thickness of the wall of water is to be proportioned to the size of the boiler, "and the above named contrivance will lessen the danger if the boat should take fire."

Let others write the commentary.

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14. For an improved *Water Chute, and Driving Wheel;* Lewis Waterbury and Talmage Waterbury, Malta, Saratoga county, New York, April 12.

The alleged improvement which forms the subject of this patent, is applied to the flutter wheels in common use for saw, fulling, and other mills, and we are informed that the patentees have proved experimentally that it will produce a saving of one-fourth of the water, or, which is the same thing, enable the mill to perform one-fourth more work. Although this may have been the case with their own mill, we really believe that it will not hold good with others, and are

apprehensive that the saving which they have experienced, has resulted from other causes than those which they have assigned.

One of their improvements consists in the mode of letting the water on to the floats of the flutter wheel. The curve of the chute is not to close in upon the edge of the buckets until the latter have arrived at a point midway between a horizontal and perpendicular line, drawn through the gudgeon of the wheel; this, it is said, will allow the water to act upon a greater number of buckets. The principal improvement, however, consists in the addition of a second wheel, which is to be acted upon by the water after it leaves the first; for this purpose it is to have a descent of, at least, one inch in a foot. The first wheel may be from twenty to thirty-two inches in diameter, and have from five to twelve buckets. The second, which is an undershot wheel, should be at least three feet in diameter; and to insure the concurrent action of the two, there is to be a pulley upon the flutter wheel, of one-half its diameter, and a groove upon the periphery of the second wheel, which pulley and groove are to receive a chain, operating as a connecting band, tightening pulleys being used to prevent its slipping.

If this second wheel should enable the apparatus to overcome the friction from the chain, and the other additional rubbing parts, it will effect more than we anticipate, as, instead of an increase of one-fourth in the work performed, we should apprehend at least an equal balance on the other side of the account.

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15. For *Steam Vacuum Pumps;* Isaac Barnum, city of New York, April 16.

The apparatus here called a steam vacuum pump, is intended for the raising of water, which water, from some expressions used, we suppose, is intended to turn a mill wheel; be this as it may, the instrument is no other than Savary's steam engine, with two condensers, which are to be alternately filled with water and steam. The arrangement of the respective parts differs no more from engines upon that plan, as they were formerly constructed, than they did from each other; nor does it present any thing which appears to us to deserve the name of an improvement. Even for the simple operation of raising water, to which purpose it is better adapted than to any other, it has been abandoned for more than a century, and there is but little probability of its ever being again used, excepting as a philosophical toy. Several patents have been obtained for improvements in the steam engine, by which its operation was said to be much simplified, the simplification consisting in carrying it back to the days of Savary, and divesting it of those contrivances by which it has been rendered the most efficient of all the motive instruments.

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16. For *Roping and Spinning Cotton;* James Chesters, Cumberland, Providence county, Rhode Island. An alien, who has resided two years in the United States; April 16.

There is a good drawing accompanying the specification of this machine, with written references thereto, and in these the whole

description may be said to consist; without the drawing the things claimed cannot readily be explained. The bobbin upon which the roping is to be wound, is turned by a roller beneath it in the usual way, and the roping is to be carried from end to end by means of a horizontal shaft above the bobbin, which has upon it a right and left handed screw, between the threads of which a guide piece, or pointer, is to play backwards and forwards. The application of this screw is claimed, as is also a revolving case which covers the apparatus, and a loose pulley to regulate the tightness of a band.

17. For a *Back for a Blacksmith's Forge;* John Howe, Alna, Lincoln county, Maine, April 16.

This forge back is intended for heating the air before it enters the fire, and consists of a cast iron box, so similar to others which have been patented, as to possess no novelty, and so inferior to some of them in construction, as to lay no just claim to comparative utility.

18. For a *Machine for Sawing and Boring;* B. F. Goodspeed and D. H. Wiswall, city of New York, April 16.

Sawing and boring machines are in common use in many of our manufactories, and have been varied in so many ways according to the nature of the work to be executed, that little appears left to be done in this respect; in proof of this, the patents which have been taken for such machines, have, usually, offered little or nothing that was new, but have been merely such varied arrangements of things, previously well known, as exhibited nothing of invention. In the machine before us, the claims made are confined to such particular arrangements; a course which appears to be the only safe one in such a case. "The improvement consists in the manner of placing the cross heads of the vertical saws on a semicircular standard of cast iron or brass, cast with flanches on the sides for the clasps that are fastened to the cross heads to play up and down on; and also with a flanch at right angles with the side flanches on the circular side of the standard, of the proper thickness and length for the purpose of securing the standard to a table, or plane, which rests on a frame of cast iron of convenient height and length for the work intended to be performed." "We claim the aforesaid method of hanging the vertical saws, as well as the mode of raising and depressing the auger."

Although there is a good perspective drawing of the machinery, the parts which are claimed are not clearly explained, or distinctly represented; a workman, therefore, who should attempt to build a machine from the drawing and specification, would have to resort to his own inventive powers in order to complete his work.

19. For *Self-igniting Cigars;* John Marck, city of New York. An alien, who has given notice of his intention to become a citizen of the United States; April 16.

To the end of the cigar a paper box, or receptacle, is to be attached, containing any of the chemical compounds which ignite by fric-

tion or percussion, to which is to be added a piece of tinder, or spunk, to insure the ignition of the tobacco.

If care be not taken these cigars will become self-smoking as well as self-igniting; for it has frequently happened to boxes of prepared matches to take fire from some accidental force, when the whole have been rapidly consumed. As these cigars will, for a while, be objects of curiosity, they will have their day, and may thus, possibly, answer the purpose of the patentee; more than this we do not anticipate.

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20. For a *Diving Suit;* Nathaniel Wolcott, Sidney, Delaware county, New York, April 18.

The suit described is to be a covering for the body, made of water proof leather, oil cloth, or cloth coated with India rubber. The description of its construction, with that of a cap for the head, furnished with holes closed by glasses for the eyes, and tubes to supply air, differs so little from what has been long known and used, that we cannot tell what it is intended to patent, particularly as the description is altogether general, without any attempt to claim, or to point out, what is considered as new. There is a particular description of the straps, &c. by which the suit is to be secured in its place, but these find no place in the drawing, nor indeed is the specification accompanied by any thing which can be properly so called.

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21. For improved *Bellows;* James Robe, Morgantown, Monongalia county, Virginia, April 17.

The bellows here described are intended for a smith's forge, or, when of sufficient size, for furnaces, &c. The body of the bellows may be a square wooden trunk, four feet high, and two feet on each side. At the lower end, a piston, or plunger, of plank, surrounded on its edges by some elastic substance, and furnished with a valve opening inwards, is to be worked up and down by a lever. A partition, or diaphragm, crosses the middle of the trunk, just below the blast pipe, and has a valve also opening upwards. Above this there is another piston fitting the trunk like the former, with a guide rod above it, to keep it horizontal; this descends by its own weight, and takes the place of the upper board in the ordinary bellows. The other parts require no description, and those who know any thing about blowing machines, will see that in the parts described there is no novelty. The patentee, however, appears to think that the whole is new, as he has not preferred any claim, but informs us that "the trunks may be made round, octagon, square, oblong square, or any other form that fancy may suggest."

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22. For an improvement in the *Throttle Valve of Steam Engines;* Augustus S. Dawley, Boston, Massachusetts, April 18.

This throttle valve, instead of being in the usual form of a circular disk, operates like some slide valves, in which the valve and seat both consist of alternate bars and slots, the whole of which slots are closed or opened to an equal extent simultaneously; in the arrange-

ment now patented, however, the valve seat, instead of having its surface flat, is in the form of a hollow segment of a cylinder, and the valve is ground to fit it, whilst it works on pins in the centre of its curvature. When the stem of this valve is moved by the action of the lever, or rod, from the governor, all the slots opening or closing at once, the action of the steam is more immediate, with a small degree of motion, than with the ordinary disk valve, and the engine is in consequence more quickly advanced or retarded, and a more equal action insured. The claim is to "the construction of the throttle valve as above described, with openings, or slots, for the purpose of a quick regulation of the admission of the steam from the boiler to the cylinder."

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23. For a *Machine for Pressing Puddlers' Balls;* William Jones, Haverstraw, Rockland county, New York. An alien, who has resided two years in the United States; April 18.

This machine is intended to press the balls in the puddling of iron, instead of hammering them. It consists of a beam of cast iron, called the squeezer, which is moved on a pivot by means of a lever, acted on by a crank; there is a cast iron bed upon which the balls to be pressed are placed. The squeezer is of a triangular form, and may be single or double; when double, it resembles two triangles joined at their bases. The general construction of the machine, and the mode of using it, are presented in very general terms, and as the drawing does not represent the parts sufficiently in detail to enable us to understand it completely, we must leave it to those who are adepts in the business to which it is to be applied.

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24. For an improvement on the *Rack Wrench*, invented by Henry King; Solyman Merrick, Springfield, Hampden county, Massachusetts, April 18.

(See specification.)

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25. For *Heating and Applying Air to Blast Furnaces;* Isaac Tyson, jr., city of Baltimore, April 18.

(See specification.)

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26. For an improvement in the *Fly Net for Saddle, Gig, and Carriage Horses;* Henry Korn, city of Philadelphia. First patented September 12, 1829. Patent surrendered and reissued April 19.

We noticed this patent under its proper date, and pointed out what we deemed defects in the specification; these the patentee has essayed to remove by a reissued patent, in which he claims "the making of fly nets for horses, by weaving, plaiting, or braiding, from a material not heretofore employed for that purpose; namely, from braid of silk, worsted, cotton, or other fibrous substances; which braid is to constitute the ribs, or thongs, of the said fly net. I also claim the uniting together of the longitudinal straps, and the ribs, or thongs,

by weaving, plaiting, or braiding, whether the material used for the ribs, or thongs, be twisted cord, or braid."

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27. For an improvement in the *Fly Net for Saddle, Gig, or Carriage Horses;* Henry Korn, city of Philadelphia. First patented December 8, 1831. Patent surrendered and reissued, April 19.

"All that I claim as my improvement," says the patentee, "and for which I ask the present patent, is the making of the fly net for the neck and shoulders of the horse, with two straps inclined towards each other, in the manner and for the purpose herein described; the material of which my nets are made, and the manner of connecting these materials by weaving, plaiting, or braiding, being the same as that described and claimed by me in my patent of September, 1829."

It is unnecessary to point out to any one the neatness, lightness, and beauty of the fly nets now used for horses, and manufactured under the foregoing patents. They appear, indeed, so perfect as to leave nothing to desire upon the subject, excepting it be the miraculous aid of some kind Saint, who would drive away those troublesome insects by which this appendage to harness is now rendered necessary.

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28. For a *Machine for Hulling Cotton Seed;* Henry Hubbard, Claremont, Sullivan county, New Hampshire, April 19.

The seed is to be put into a feeding hopper which opens over what are called cutting cylinders; within the feeding hopper there is a revolving cylinder, set with teeth, spirally, to feed the seed to the cutting cylinders. These cutting cylinders are of iron, and have their circumferences worked into broad flutes, passing spirally, there being five of them in an inch, each one-sixteenth of an inch deep. These are driven by proper gearing, and are intended to break and loosen the hull; but to complete the process, the seed falls from them, and passes between a cylinder and concave, both of which are thickly set with teeth, arranged spirally; the latter cylinder is called the beating cylinder, and is one foot in circumference; this, it is said, will completely separate the hull from the seed, which is cleaned by passing into a sieve, and being subjected to the action of a fan.

The perfect novelty of all the parts of this machine, is something more than doubtful, yet we are left to conjecture what it is intended to patent, as no claim is made.

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29. For an improvement in the common *Furnace Stove;* James Atwater, New Haven, Connecticut, April 19.

The stove designed is of the ordinary vertical, cylindrical form. From the head, or cap, of this stove, two draft pipes are to project horizontally from opposite sides; these are then to bend down and extend as low as the floor, parallel to the body of the stove, on each side of it; they are then to bend back horizontally, and afterwards to ascend vertically, and both to unite in one common pipe of larger dimensions, which is to lead into a chimney, or other proper place

of exit. There are to be valves in the respective pipes to regulate and direct the draft, as may be desired; and some directions are given respecting the grate bars, and other appendages, which do not affect the general principle.

The claims made are to the adjustment of the several pipes and valves, so that the draft may be made to pass directly upwards through the fuel, or have an indirect course through a series of pipes near the body of the stove; or downward through the fuel, and a rear pipe, and ultimately pass off in the usual manner. The combination of any two of said drafts is also claimed, but the particular parts, individually, are not claimed as making any part of the invention.

We could find some stoves, patented and unpatented, with pipes and valves so arranged as to bear much resemblance to the foregoing, and we greatly err if the same principle does not obtain in some of the patented contrivances of Mr. Atwater himself.

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30. For a *Washing Machine;* Philip Horney, Randolph county, North Carolina, April 21.

This washing machine is the ordinary revolving barrel, and the claim made is not to this contrivance, but to "the mode of grooving or fluting the cylinder on the inside, and making use of a revolving roller, wallower, or reel, within, to rub and press the clothes."

This latter appendage has no claim to novelty; and the former, if new, is of but little importance standing alone.

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31. For a *Machine for Filing Accounts;* Samuel Argell, Providence, Rhode Island, April 22.

Two boards, each ten inches long, and three and a half wide, are to contain the folded accounts between them. Upon the upper board there is a small cylinder turning between two standards, to which cylinder, the ends of a strap, or belt, are fastened; this strap passes through a slot made edgewise in the lower board. One end of the cylinder has a ratchet and click attached to it, and the other a thumb piece for turning it. The papers are to be placed between the two boards, and upon turning the cylinder, the strap will wind round it, and draw the boards together, when they will be held by the ratchet. One end of the upper board has a hinge and button, allowing it to be turned up to examine the labels, without loosening the strap.

This little machine will undoubtedly accomplish the object for which it is constructed, but it will hardly come into use where files are numerous, and referred to at distant periods. The cylinder and its appurtenances will render it inconvenient to stow away the files upon each other; where these are few in number, however, it may be considered as a neat and useful article.

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32. For *Igniting Gunpowder in Discharging Artillery, &c.;* Alexander Jones, Mobile, county of Mobile, Alabama, April 22.

Gunpowder is to be ignited in the blasting of rocks, the firing of artillery, &c. &c. by means of hydrogen gas and spongy platina.

The mode in which this is to be effected can scarcely be said to be described by the patentee; for, although not quite uninformed on the subject of chemistry, we should have to invent the apparatus to be used, after making ourselves masters of all the directions afforded in the specification, before we could set fire to gunpowder, in the way proposed. We are merely told that the hydrogen is to be generated in the usual manner; that it is to be conducted along a tube of lead of any desired length, at the end of which there is to be a small piece of platinum sponge in contact with the gunpowder; that the gas is to be passed into the tube by means of a cock, and that the explosion will then be almost instantly effected. Those acquainted with chemical manipulation, need not be informed of the inadequacy of these directions; and to those who are not so, any animadversions respecting them would be uninteresting.

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33. For improvements in the *Mode of constructing Steam-Boats, and other Vessels, and in the manner of propelling them;* Anthony Plantou, city of Philadelphia, April 23.

Two or more hollow trunks are to be made perfectly water tight, and as long as, or a little longer than, the boat; they may be rectangular, and tapered, or pointed, towards their ends. These are to be placed parallel to each other, one on each side of the boat when there are two, and one also in the middle of it, should there be three. Between these, transversely, there are to be hollow water-tight cylinders, turning on axes, or gudgeons. The number of these cylinders is to be regulated by their diameter, and the length of the boat; they, however, are to be as numerous as these dimensions will allow. Each of the cylinders is to be surrounded by paddles, or floats, from two to six inches in width, and which are to extend from end to end of the cylinders. These hollow cylinders are to concur with the trunks in giving buoyancy to the boats; they are to be geared together, and acted upon simultaneously by the power employed. The boat, with its machinery, is to be elevated above these trunks and buoyant cylindrical propellers. In the trunks and cylinders there must be sufficient buoyancy to prevent the latter from dipping so deep as to interfere with the propelling action of the floats.

The patentee does "not claim to be the inventor of hollow cylinders surrounded with paddles, or floats, nor to be the inventor of hollow trunks to give buoyancy to a boat; nor to be the first who has found out the means of making unsinkable boats;" but what he does "claim, is the combination and arrangement of the several parts, as above described and specified, in order to obtain buoyancy, velocity, and safety."

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34. For improvements in the *Apparatus and Process for Manufacturing the Prussiates of Potash and Soda*, and for other purposes; Felix Fossard, city of Philadelphia; an alien who has declared his intention to become a citizen of the United States, April 23.

The specification of this patent enters into very minute and extended details of the machinery and process to be employed, covering twenty-eight closely written pages, and referring to drawings of considerable complexity. This patent may be said to be supplementary to that obtained by the same gentleman on the 14th of December, 1832, and of which we gave some account at page 182, vol. xi. As we cannot furnish a detailed analysis of this specification in the space which we could devote to it, we shall pass it over altogether, referring those interested in the subject to the files of the patent office, merely remarking that we have seen no reason to withdraw the favourable opinion expressed by us respecting the former patent.

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35. For a *Marine Dress for Descending in the Water;* Fowler Smith, and Lewis S. Steele, Norfolk, Norfolk county, Virginia, April 23.

The description of this dress tallies precisely with that given in No. 20, the only variation named being the employment of brass screws, like hose screws, to attach the body of the dress to the cap and pantaloons. There is no claim, and as we have made some remarks upon the compeer of this patent, we refer the reader to them, with the exception of what relates to the drawing, that furnished in the present instance being sufficiently descriptive, and looking very much like some of the numerous engravings representing similar apparatus, in scientific works.

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36. For *Tempering Tanners' Fleshers, and other edge tools;* John Glenn, Champaigne county, Ohio, April 24.

Although there are but few processes in the arts which do not admit of improvement, there are some which are so well understood, that the changes by which they are supposed to be improved, are received with some scepticism by those who are well acquainted with the subject. The hardening and tempering of steel is one of the processes to which we allude; for effecting these operations, several patents have been obtained, the greater number of which are utterly worthless, and we see no reason for removing this new attempt out of the general list.

The flesher, we are told, is to be plated out of solid cast steel, and tempered by being heated to a dark cherry red, and held in water until perfectly cold. The flesher, or any number of them, is then to be placed in a cast iron box, and covered with oil, tallow, or other grease; this is to be heated for half an hour, as hot as it will bear without blazing, and then laid out to cool.

The foregoing contains the whole process, in which there is nothing new, and which, in many cases, will not answer the intended purpose, more especially as it is to be applied to "all other edged tools," which require very different degrees of temper.

Were all cast steel alike, it would, of course, all harden at the same degree of heat, but this is far from being the case; and besides this, "a dark cherry red" will be very different by day light, and in

the dark, and will vary with every degree of light admitted; the bath of grease, also, is very inferior to other modes now practised for giving a uniform heat in tempering, the fusible alloys being much more perfect. As to keeping the pieces in for half an hour, this is no more necessary than to keep them there for half a day. When brought to the proper heat, the steel will be at the same temper as it will if kept at the same degree for any length of time.

The patentee has made no claim.

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37. For *Hulling Clover-Seed;* William Rowe, Phillips, Somerset county, Maine, April 25.

A conical tub is to be made, and lined with perforated sheet iron, and within this, a conical core, or nut, is to revolve, having perforated sheet iron fixed spirally round it, forming a kind of screw. The chaff and seed are afterwards to be separated by sieves and a fan. All this, it will be seen, resembles what has been before done, and so far as a claim is concerned, we might infer that the patentee is of the same opinion, nothing new being pointed out.

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38. For a *Machine for Sawing Shingles;* John W. Smith, Montgomery county, Virginia, April 25.

The patentee claims the machine "according to the plan described, and the *model* deposited in the patent office;" which latter, we suppose, must be the principal reliance, as the description and drawing are very far from showing how the machine is to be used, there not being a word said about the kind of saw to be employed, or the mode of applying it.

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39. For a *Blacksmith's Striker;* William B. Dobson, Surrey county, North Carolina, April 25.

The hammer is to be brought down by placing the foot on a treadle, a chain or rope from which passes round a roller to which the hammer helve is attached; a spring above, with a rope or chain passing round the same roller, serving to raise it.

There is no great difference between this contrivance and that noticed at p. 172, vol. 15, as patented by Mr. Lewis Stripe, to which we refer.

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40. For a *Thrashing Machine;* Ebenezer Chandler, and Joseph A. Holland, Kennebec county, Maine, April 25.

This machine is intended principally for getting out clover or other small seeds, and consists of a convex cylinder, covered with perforated sheet iron, revolving within a concave cylinder, similarly covered, and divided into segments, so fixed as to give way in case of any extraordinary resistance. When used for wheat, &c., to which it appears to be but indifferently adapted, it is to be somewhat modified. Much pains are taken in describing the form and arrangement of the perforations in the two cylinders, but nothing is pointed out as new, the

whole being placed in the same point of view, as the invention of the patentees.

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41. For an improvement in *Washers for Paper Engines;* Clark Rice, Watertown, Jefferson county, New York, April 26.

The manner of constructing the washing apparatus adopted by the patentee, is very minutely described in the specification. In some points it resembles that patented by Mr. Thomas Goucher, the specification of which may be found at p. 259, vol. xii.; but there are also considerable differences between them. The claim made is to the peculiar manner in which the vellum or wire cloth is kept free of rags, or pulp, in the various stages of washing, and in which the egress of water is accomplished; that is to say, by causing an extra pressure or current, and a gathering of head, by narrowing the passage, or otherwise compressing the rags in that part of the engine where the washer or vellum is placed; and also the combination and arrangement of the several parts of the machine by which the same is effected, as described and set forth.

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42. For a *Thrashing Machine;* Richard P. Sutherland, Chatham, Columbia county, New York, April 26.

There is no pretension to any thing new in this thrashing machine, the specification of which would answer equally well for some score or two of others previously patented. Cylinder, concave, teeth, springs, hopper, &c. &c., are all old acquaintances, and all seated in their accustomed positions.

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43. For a *Roasting Jack;* Ezra Whitman, Jr., Winthrop, Kennebec county, Maine, April 28.

This is a more complex and less convenient apparatus than the old fashioned English roasting jack, fifty of which have been brought into this country for one that has been used. The spit in this roasting jack is to be vertical, and to receive small cross bars, to which birds, chops, &c. may be suspended. It is to be turned by a weight, a rope from which passes round a drum. By an additional bevil gear, it is to be made to turn a coffee roaster, and the motion is to be regulated by a fly wheel, or by a pendulum, with its escapement. A claim is made to "the combination of machinery as above described, to turn meat, or coffee, whilst roasting; and particularly to the using one or more upright spits; and the addition or application of the coffee roaster."

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44. For an *Endless Chain Rotary Pump;* John C. Pitts, Winthrop, Kennebec county, and Hiram A. Pitts, Livermore, Oxford county, Maine, April 28.

This is the old chain pump, "unanointed, unannealed," "as it was in the beginning." An endless chain is to pass round two pulleys, one above the pump, and the other at the bottom of the well, and upon this chain round disks of wood, about two inches thick, are to be

placed, the diameter of which is to be such as nearly to fill the bore of the pump at the lower end, where, for two or three feet from the bottom, it is to be somewhat smaller than above. Leather is to be nailed upon the tops of the buckets or pistons, so as just to fill this part of the bore.

After all this has been done, should the well be as deep as usual, one of the least efficient kind of pumps will be placed in it, which will afford more labour than profit. Those who read books of mechanical science, will not need any reference to pumps such as is here described. The patentees have very properly omitted to make any claim.

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45. For a *Screw Drill Stock:* Charles Babbitt, Taunton, Bristol county, Massachusetts, April 29.

This drill stock consists of a head, or handle, which may be of ivory, into which is fitted the upper end of a cast steel arbor, or shaft, which may be a quarter of an inch, or upwards, in diameter, and six or seven inches long. The part which fits into the ivory head is turned small, and revolves freely in it as in a collar, being kept in its place by a pin working in a groove. The drill fits into a socket at the lower end of the shaft. Grooves are cut upon the shaft, from end to end, forming a three threaded screw, and upon this is fitted a nut of brass, or other material, which, when taken between the finger and thumb, and worked up and down, causes the shaft to revolve. This apparatus is simple, neat, and ingenious, and, we suppose, is intended principally for the use of dentists, and for other purposes where but little force is required.

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46. For a *Machine for Hulling Clover, and Thrashing small Grain;* Henry Bangs, city of New York, April 29.

The wood work of this thrashing machine is framed together in a form somewhat different from that usually given to this part, but in other respects it offers nothing new; the first part of the claim is to "the general construction of the frame," which, had it stood alone, might have passed; but to this are added "the particular manner of building the cylinder, and the manner of breaking off the wind." This latter claim is to embrace "a board hung to the wind spout, which, when thrashing grain, is let fall against the slide board, and fills up the space, that no air may be drawn down that way to blow the dust against the person feeding."

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47. For a *Mill for Grinding Bark, Cracking Corn, Gypsum, &c.:* Milo J. Whiton, Amsterdam, Montgomery county, New York, April 30.

This is a cast iron mill, with the ordinary shell and nut, furnished with teeth, but so arranged that the patentee thinks it presents some novelty, which, however, is not of a very visible or tangible kind; but he claims "as original the oval like shape of the nut, and the equal

bevil on each side of the fine teeth, together with the spiral position in which the teeth are placed on the curb and nut."

48. For *Extracting Fur from Skins:* Levi Ward, assignee of Phebe Atwell, Marion, Wayne county, New York, April 30.

The process here patented is said to be adopted for the purpose of manufacturing the fur into yarn for making mittens, gloves, &c., and is as follows:—Apply alkali to the flesh sides of the skin, until the hair and fur become loose; then pull and remove the hair, and afterwards pull out the fur, which is to be dried, oiled, carded and spun.

What kind of skins and fur are to be thus treated, we are not informed; nor are we told what kind of alkali is to be employed, or the time or manner of its application—all which things should have been explained. In many instances lime is ranked with the alkalies, and it is that one which has been commonly used in the removing of hair and fur from skins; and in those which are to be tawed, it is applied on the flesh side, as pointed out in the foregoing specification.

49. For a *Self-Inking Machine*, applied to the Horizontal Printing Press; William J. Spencer, city of New York, April 30.

Those acquainted with the subject in question, are aware that several plans have been devised and patented for inking the form on the common hand press, without the employment of an additional hand. The present patentee, however, seems to be inclined to claim the first place among the contrivers of these machines, as he says: "I originally invented this machine in Canada, in the year one thousand eight hundred and twenty-eight, and have now brought it into easy and necessary use; by it the labour of an additional hand is saved, and the exertions of the pressman but lightly increased."

At least two patents were obtained in the United States in the year 1829, for the above purpose, and as these plans were carried into operation five years ago, it is not likely that the present patentee will be able to establish a prior claim, as, by his own showing, he has only "now brought it into easy and necessary use." If his claim is admitted, however, the first shall be last, and the last first, as he says, "I claim as new, and as my own discovery for the application of a self-inking machine to the ordinary horizontal hand press;—the ink trough, rollers, and straight edges as cut, are known and used before. I also claim for the contrivance, means of the combination of the cords, loose pullies, acting on the shaft, and catches and teeth by means of which is produced a continued revolution of the wooden roller in one direction by means of the action of the rounce, which moves backwards and forwards with the issuing and return of the bed of the hand press."

We hope that his machinery rolls on more smoothly than does his description of it.

Specification of a patent for an improvement on the Rack Wrench patented by Henry King. Granted to SOLYMAN MERRICK, *Springfield, Hampden county, Massachusetts, April* 18, 1834.

To all whom it may concern, be it known, that I, Solyman Merrick, of Springfield, in the county of Hampden, and state of Massachusetts, have invented an improvement in the Rack Wrench invented by Henry King, and for which letters patent of the United States were granted unto him, on the 25th of October, 1832; and I do hereby declare that the following is a full and exact description of my said improvement.

The main bar, the slide, and the spring click, may be made in the same form and manner as those in the original Rack Wrench upon which this is an improvement; but instead of cutting the notches in which the spring click is to catch, directly upon the main bar, I make a sliding rack, of such length as may be necessary to regulate the distance of the jaws from each other, which rack I place in a groove on the upper side of the bar. Upon this sliding piece I cut teeth, or notches, to receive the spring click, either at equal or at graduated distances from each other. This sliding piece, or movable rack, is to be acted on by a screw, which must cause it to traverse backward and forward to a distance equal to that of the widest tooth in the rack. What I deem one of the best modes of arranging the parts so as to accomplish this end, is the following.

I make the shank of the bar, or that part of it which passes through the handle thereof, round, and form a square shoulder at the point where the square bar commences; over this round part I drive a turned collar, which bears against the square part of the bar, and there forms a flanch, which keeps one end of a nut, or ferule, in its place, which passes on to, and revolves freely against it. A groove is made through this collar, to correspond with that on the main bar, that the rear end of the sliding rack, before described, may pass through it. On this end of the rack, spiral grooves are cut, which match into the threads of a female screw cut upon the inside of the revolving nut, or ferule, just alluded to. This revolving ferule is then passed on to, and against, the aforenamed collar, being screwed round so that the threads on its inner surface may take on to spiral grooves, which form a segment of a male screw on the end of the rack. Another circular collar, of the same diameter with the former, which is equal, or nearly equal, to that of the revolving nut or ferule, is then driven over the shank, and against the nut, but not so closely as to interfere with its revolving motion. The wooden handle may then be driven on the shank, and rivetted in its place. The outer surface of the nut should be milled, that it may be the more readily turned round by the hand.

It will be seen that, by this arrangement, whenever the slide is placed to the nearest desirable point on the rack, the jaws can be readily and precisely adjusted by turning the nut.

Although I have pointed out what I deem to be the best mode of arranging the parts so as to adjust the sliding rack, I do not intend thereby to confine myself to this particular arrangement, but to vary the same in any way which is in accordance with the general principle or mode of action hereinbefore set forth, and by which a similar effect is produced; limiting myself, in my claim to improvement, to the addition of the movable or sliding rack, operated upon, and adjusted, by a screw. SOLYMAN MERRICK.

Remarks by the Editor.

We have seen some of these wrenches, and esteem them as not only the neatest, but the best articles of the kind that have ever been manufactured for sale. There are, we are informed, a considerable number of hands employed in making them; but the demand for them is so great, that they have not yet found their way, in numbers, to any great distance from the manufactory, in Springfield, Massachusetts. We have no doubt, that, in point of strength and durability, they excel, in a triplicate proportion, the imported wrenches of the same size; and they equally exceed them in point of workmanship, whilst they are afforded at but a small advance in price.

Specification of a patent for an improvement in the mode of making Water Proof Boots and Shoes. Granted to EDWIN M. CHAFFEE, *Roxbury, Norfolk county, Massachusetts, May 17th,* 1834.

To all whom it may concern, be it known, that I, Edwin M. Chaffee, of Roxbury, in the county of Norfolk, and commonwealth of Massachusetts, have invented a new and useful improvement in the mode of making water proof boots and shoes, from India rubber leather, or India rubber cloth, by cementing them together at the seams, thereby dispensing with sewing altogether; and that the following is a full and exact description of my said improvement:

In the first place, I take the India rubber leather, or India rubber cloth, and cut out the pattern of the boot or shoe in the usual form, and also the lining, which must likewise be of India rubber leather, or India rubber cloth, so that, when the outside and the lining are put together, the India rubber surface of both outside and lining will come together, and adhere, on being wet with a solution of India rubber in spirits of turpentine, and pressed together with the hands.— The seams which close the quarter and the vamp together, are made in the following manner. The lining of the quarters is cut about one-quarter of an inch longer than the outside, and the lining of the vamp is cut as much shorter, so that the lining of the quarter overlaps the joint or seam of the outside, and the joint or seam of the lining is overlapped by the outside of the vamp. In addition to this, a piece of cloth or leather, three-fourths of an inch wide, and as long as the seam, which I call a stay, is cemented between the outside and the lining, and breaks the joint or seams of both. The quarters are closed together in the same manner when they are cut in two pieces, and a

stiffener is cemented in between the lining and the outside, in both cases.

The inner sole is then fitted to the last in the usual manner, and is then coated with the solution, or cement. The uppers are then put on the last, and the inside of the lining is then coated with the cement around the bottom edge, and as wide as it is to come in contact with the inner sole, when drawn over it, to which it is secured by merely pressing it with the hand. The bottom is again coated with the cement, as far it is required to have the outer sole adhere, and the outer sole is then coated on the inside, and put on, and pressed with the hands, till it adheres firmly. The heel is also cemented on in the same manner; but if a spring heel be wanted, it must be put on before the outer sole.

After the shoe is dry, it is then trimmed off, and bound in the usual manner.

What I claim as my improvement, is, the construction of water proof, or other boots and shoes, upon the principles above described.

EDWIN M. CHAFFEE.

Remarks by the Editor.

On a late visit to Boston, near to which is the manufactory of these shoes, and of other articles rendered water proof by means of India rubber, we had an opportunity of examining them in great variety. They are perfectly neat in their appearance, and we see no reason to doubt their durability; they are not, when on, and scarcely when off, distinguishable from those made in the usual way; and for ladies especially, to whom fashion has assigned a covering for the foot, which affords it but little protection against wet, they are especially desirable. But, although all ought to have them, they are not adapted to general use. Shoes made water proof, in any way, confine the perspiration of the feet, and would soon, even in cool weather, but more especially in summer, produce very unpleasant effects, as has frequently been noticed by those who have persevered in using them.

Mr. Samuel D. Breed, of Philadelphia, has a previous patent for attaching soles to shoes by means of India rubber.

ENGLISH PATENTS.

Specification of the Patent granted to CHARLES JOSEPH HULLMANDEL, *Printer, for a certain Improvement in the art of Block Printing, as applied to Calico and some other fabrics. Sealed Oct.* 28, 1833.

To all to whom these presents shall come, &c.—Now know ye, that in compliance with the said proviso, I, the said Charles Joseph Hullmandel, do hereby declare the nature of my said invention to consist in doing away with many of the difficulties and inaccuracies of that part of the process of blocking printing called "putting on," and lessening the time usually occupied therein, by applying a certain mode of engraving and printing thereto. And in further compliance

with the said proviso, I, the said Charles Joseph Hullmandel, do hereby describe the manner in which my said invention is to be performed by the following statement thereof, (that is to say:)

Having procured an original pattern, as drawn by the artist, I place upon it a sheet of that transparent substance made from isinglass or gelatin, known by artists and sold in Paris by the name of papier glace, and in London by the name of glass paper; I then take a fine sharp tracing point, and make a tracing of the pattern in such manner as to form, in fact, an etching or incised outline on the papier glace; this done, it will be found that the tracing point has raised a slight burr on each side of every line; this must be removed by a sharp scraper lightly passed over the surface of the papier glace: when this is done, the papier glace is to be treated as an engraved copper plate, and having been inked with printer's ink, and cleaned off in the usual way, an impression must be thrown off from it upon thin oiled silk, by means of an ordinary roller press, care being taken that the papier glace should be uppermost, or next to the roller, and the oiled silk undermost, or on the bed of the press. The impression thus obtained on the oiled silk is to be turned down on the block, and transferred to it by slightly rubbing it on the back. The same piece of papier glace will give off a great number of impressions; and thus by having numerous pieces of oiled silk, with one person to attend the press and one to transfer to the block, an often-repeated pattern may be put on, as it is called, in a very few minutes; and the hand of the artist now required to redraw and complete the present blurred impression on the block, by making a perfect outline with a brush and carmine, entirely superseded. It should here be stated, that the papier glace will not bear any application of water to its surface, and that all the inks used for impressions to be taken from it, must therefore be what are termed fatty inks; and as it is necessary, in the process of putting on, sometimes to use different colours for different parts of the outline, as also, on certain occasions, to use colour which will withstand the wetting which the block has sometimes to undergo, I shall now proceed to name several inks suited to that purpose, which, though they form no part of my said invention, will nevertheless enable the manufacturer to make use of my said invention to greater advantage, and in a more extensive way.

Instructions for making the said Inks.

Take some varnish, (burnt linseed oil,) mix with it a little tallow and some sweet oil—lay this by for use.

For Red Ink.—Mix some of the above with as much carmine as it will take; the stiffer the ink is made by adding colouring matter, the sharper the impression will be. Previous to throwing off or transferring the impression to the block, the latter must be well washed with a solution of caustic potash or soda, and allowed to dry; and be it recollected, that with this ink, as well as with all the following, immediately or some time after the impression is taken, a sheet of clean paper must be put over or laid on the block, and a hot iron run over

it to fix the ink; while the wood is still hot, pour over it a solution of alum, and if the yellow tinge produced by the caustic, potash, or soda, still remains, and it is wished to be removed, a weak solution of muriatic acid will effect the purpose. You may, in grinding this ink, add a small portion of dry soap.

For Black Ink.—Take about equal parts of nitrate of silver, commonly called lunar caustic, and varnish; add a little lamp black, merely to colour the ink, and grind the whole well on a glass or marble slab. For this ink the block may or may not be washed with a solution of caustic, potash, or soda. When the block is washed with a solution of wax in turpentine, varnish and lamp black only may be used for throwing off impressions: when this solution is adopted, do not use a hot iron after the transfer is finished, but merely hold the block near to the fire; this will fix the pattern.

For Blue Ink.—Grind equal parts of green sulphate of iron, dried over the fire, and common red ochre, or any colour containing iron. (add a little indigo to give colour to the ink.) with varnish.—Wash the block with prussiate of potash, and caustic soda, or potash. After the impression has been fixed with a hot iron, pour some muriatic acid (diluted) on the whole, (do not use a brush for this operation, or the lines will smear,) to bring out the colour.

For Blue Ink with Indigo.—Grind, very fine, some indigo with varnish, and, if thought proper, some yellow orpiment. Wash the block with a solution of caustic potash.

Now it is evident that my said invention is applicable to all those styles of block printing, where the process called "putting on" is used, and various modes of availing himself of it, in the whole or in part, will occur to the manufacturer, which it would be unnecessary here to enumerate; thus, for instance, when part of the pattern is made from engraved rollers, the remainder may be traced on papier glace; or where the brassed blocks, as they are called, (the putting on of which has been performed as aforesaid) are used, an impression may be taken from them on fine oiled silk, and then such parts of the pattern as are to be transferred to blocks may be outlined by hand on the silk with the aforesaid inks, and the silk then turned over on the block, and an impression given of the pattern on the block, without the ordinary hammering or blows on the back of the block. Another great advantage of this mode of proceeding as regards brassed blocks, is, that though the whole brassed pattern will be given on the oiled silk, only so much as is necessary to guide the cutter will be transferred to the other block, which will cause much less confusion to the cutter. It is only necessary further to add, that the papier glace (if that be the transparent substance used) should be kept in a dry place, and when engraved, if laid by, will serve to renew the pattern, at a very short notice, at any time when required, and when no longer wanted may be melted up and formed into new sheets of papier glace.

Now whereas, I claim as my invention, etching or scratching a copy of the pattern to be used in block printing on a transparent substance, such as the said papier glace, while placed over the original pattern drawn by the artist, and then by means of coloured inks suited to the

transparent substance used for the etching, as also to the wetting of the blocks when cutting; throwing off a print from the etching in an ordinary copper-plate printing press, in the manner aforesaid, upon a thin oiled silk, and transferring the same on to the block while the ink is wet, by turning that side of the silk containing the impression over on the block, and applying slight friction and pressure to the back of the silk, as aforesaid. [*Rep. Pat. Inv.*

Specification of a patent granted to JOHN MILNE, *Architect, for a machine or engine for dressing of stones used in masonry, by the assistance of a steam engine, a wind, a horse, or a water power, whereby a great quantity of manual labour will be saved. Sealed 15th September,* 1829.

A machine for picking and dressing stones by attaching the tool to a falling lever, worked like a tilt hammer, the stone being placed upon a movable carriage below, formed the subject of a patent granted to Alex. Dallas, in April, 1824. The invention of the present patentee is for the same object; but in this instance the tools (for there are many) are attached to the periphery of a rotary drum or barrel, and the block of stone is progressively carried along upon a sliding frame under the rotary drum.

The barrel or drum is proposed to be of from eighteen to thirty-six inches in diameter, and from eighteen to forty-eight inches long. Round the periphery of this drum, the tools, whether pecks, chisels, addices, or droves, are to be placed in several series spirally, that is, winding round the periphery of the drum like a screw, so that the several tools may in succession be brought into operation one after the other, upon different points of the stone.

The stone intended to be dressed is, in its rude form, to be fastened upon the sliding carriage by cramps, and, as the drum goes round, the carriage is intended to move on slowly, so that the points of the tools may strike against and chip off portions of the surface.

When the stone has passed once under the operation of the tools on the rotary drum, it is to be slidden back again upon its carriage; and the frame of the carriage with the stone being then raised a trifling distance by means of segment racks and pinions beneath, the carriage with the stone is again passed under the rotary drum, and the tools, pecking as before, chip off further portions of the irregular surface. This operation is to be repeated, and the position of the stone shifted, until the surfaces are worked down or dressed to the desired figure.

The rotary drum carrying the working tools is proposed to be driven by toothed gear connected with a steam engine or other first mover, and the progressive motion of the carriage on which the stone is supported, may be produced by connecting it with the rotary motion of the drum, or the carriage may be moved independently by hand. If the former contrivance is adopted, it is obvious that any

desired speed may be given to the carriage by changing the wheels of the gear which connect the drum and the carriage together.

It is proposed when bevils are desired to be worked upon the surface of the stone, that the rotary barrel should be shaped accordingly, and the tools adapted both in position and figure to produce such surfaces. In a similar way it is proposed that grooves may be cut in the stones, and that after pecking, the surface may be rendered smooth by the tools called droves.

The patentee does not confine himself to any particular forms, dimensions, or positions of the parts, but claims a rotary drum or barrel, carrying the dressing tools, and a carriage beneath for conducting the rough stone along for the purpose of bringing it under the operation of the rotary drum. [*Jour. of Arts.*

Specification of a patent granted to THOMAS SHAW BRANDRETH, *Barrister at Law, for a new method or methods of applying animal power to machinery. Sealed 9th September,* 1829.

The subject of this patent is one of the varieties of locomotive machinery in which a horse or other animal is placed within the vehicle for the purpose of exerting his muscular strength, by pushing with his feet against a receding floor, connected by gear to the running wheels of the carriage.

Upon this principle the power has usually been obtained by the horse or other animal walking upon an inclined plane, or upon the descending part of the periphery of a rotary drum as a treadmill; in which cases the gravity of the descending weight of the animal, principally, produced the power by which the machinery was to be actuated. In the present instance, however, the muscular exertion alone is brought into operation, the weight of the animal not being made conducive to the production of power.

The present machine, which is denominated a Cycloped, is intended to be the agent for drawing a series of loaded carriages behind it upon a railway. Four running wheels, like those usually employed for railway carriages, are affixed, two to the fore axles, and two to the hinder axles of the cycloped, the axles turning in bearings secured to the under part of the horizontal frame of the carriage. Two cylindrical barrels are also mounted upon axles supported by the frame, round which barrels an endless band, or two parallel endless chains, are passed. To this endless band or chains a series of transverse battens or rails of wood, placed close together, are attached, which being supported by a series of small rollers, mounted transversely in the side frames of the carriage, form a horizontal platform for the horse or other animal to stand or walk upon.

The axles of the running wheels, and those of the cylindrical barrels, are connected together by toothed wheels and pinions, so that any rotary motion being given to the barrels will be communicated to the running wheels, and cause them to carry the cycloped forward.

On the top of the horizontal framework of the carriage, upright posts and side rails are erected, forming a sort of stall to enclose the horse, with a trough or manger in front, that the animal may feed as it goes on. A collar is placed round the horse's neck, with traces or chains attached to the harness, which traces are hooked to staples in the side rails.

The horse being now made to pull by his collar, the traces draw from the staples in the side rails, and in making this effort to advance, the horse's feet act as levers against the rails of the movable floor or platform, which being by these means slidden back, causes that rotary movement of the drums connected to the platform, and of the toothed pinions upon their axles, which turns the axles of the running wheels, and impels the carriage forward upon the railway, drawing the train behind it. [*Ibid.*

ON THE MANUFACTURE OF VARNISHES.

(Continued from p. 281.)

EXP. V.—*That moist Driers boiled in Varnish cause it to run in Pin-holes.*

To eight gallons of very fine African copal, during the boiling, I introduced half a pound of undried copperas and half a pound of undried sugar of lead. After the varnish had stood to settle for eight months, I varnished with it a pale patent yellow pannel; it floated very well, set and looked well for four hours, when it began to dry off in small pin-holes completely over the surface, some of the holes as large as the head of a pin. It dried off in seven hours without any tack.

EXP. VI.—*That the greater the Quantity of Driers and Acid, the larger the Pin-holes.*

I emptied six gallons out of the jar containing the last-named varnishes, then I varnished another pannel out of the two gallons remaining in the jar: the pannels dried in the same time, but went off not only into pin-holes, but into large blotches all over.

EXP. VII.—*That Particles either of Oil or cold Turpentine in the Varnish will create Pin-holes and Blemishes.*

To one gallon of body varnish, nine months old, which had been tried and found to be excellent, I introduced a quarter of an ounce of water and a quarter of an ounce of linseed oil. I heated and mixed all together, and poured it into a jar, and let it stand for three months, when I varnished two pannels, one yellow and the other light green; four hours after, when I examined them, they were about half dry, and beginning to run into pin-holes and round empty holes. I examined them with a microscope, and found a particle of oil hanging to the lower edge of every circle, and the small particles of water

had evaporated; the surface appeared as if dotted with the points of as many bristles. I repeated this experiment several times, but always with the same results.

Exp. VIII.—*That Copperas does not combine with Varnish, but only hardens it.*

Three pounds of very fine African copal, one gallon of clarified oil, and two ounces of dried copperas, were mixed off with two gallons of turpentine, which, after being strained, had been put by in an open mouthed jar for eight months; I then poured off all the varnish, not quite to the bottoms. I afterwards well washed the sediment left at the bottom of the jar with two quarts of warm turpentine, which I filtered through some very fine cambric muslin, and afterwards dried the copperas in the sun; it still weighed two ounces, and appeared like what it nearly was, powder of zinc.

Exp. IX.—*That Sugar of Lead does combine with Varnish.*

With the same quantity and quality of gum, oil and turpentine, I made three gallons of copal varnish, introducing two ounces of dried sugar of lead during the boiling. I put it in a jar for eight months. I then poured off all the varnish, and washed out the sediment with half a gallon of warm turpentine, filtered as before. I dried the residuum left on the muslin, which only weighed seven drachms, and appeared of a pearly lead colour, so that the varnish had absorbed the remainder. This varnish was very good, and dried well.

Exp. X.—*That Turpentine improves by Age.*

Three pounds of fine African gum-copal, with one gallon of clarified oil, were boiled without any driers, and thinned with two gallons of turpentine which had been kept in an open leaden cistern for upwards of two years, until it had become thickened and appeared like oil. After being mixed off and strained and set to settle only two days, I tried it on several pannels of different colours, when it dried hard, firm, and brilliant, without any tack, in less than eight hours. I kept the remainder of this varnish for twelve months, when it became too thick to use. I poured it into the gum-pot, brought it near to a boiling heat, and poured to it half a gallon of the same old turpentine, and set it aside for two days, when I varnished three fresh pannels of three different colours, which had been previously twice varnished; they all dried firm and free from tack in less than five hours, and had every appearance of fine cabinet varnish. These three pannels were afterwards laid on the roof of a shed for twelve months, and, when polished, looked solid and brilliant, and the colours were less changed than any I ever saw in the same time.

Exp. XI.—*That Varnish improves by Heat.*

Very recently I had a brick erection (two feet high by four feet wide) built all round the warehouse, with an air-furnace at one end, where-

by the heat and smoke were conveyed inside a large flue in the brick work from one end to the other, where it joined into a chimney-shaft. This brick erection was covered with foot-tiles laid in composition, and over the foot-tiles was laid a bed one inch thick of fine sand sifted. Upon this sand were set the varnish cisterns, four feet by three, and three feet deep, made of inch and quarter boards, and lined with lead. When these cisterns were filled up, each held 150 gallons, and a regular fire was kept up in the furnace every other day. During the time the fire was kept up, the varnish in the cisterns expanded to such a degree, that it rose two inches in the cistern nearest the furnace. During the time of its expansion it gave out a sickly smell of gas, turpentine, and moist air; but as soon as the furnace begins to cool gradually, the acid, moisture, and driers, descend to the bottoms of the cisterns, while the varnish on the surface attracts fresh oxygen from the air of the warehouse; so that, by alternately heating and cooling the varnish in this manner for four months, it acquired all the properties and qualities equal to varnish which has been kept without heat for twelve months. I have repeatedly tried the experiment, and always found it answer.

Exp. XII.—*That all Copal or Oil Varnishes require age before they ought to be used.*

I have frequently filled up several cisterns of varnish, each containing 150 gallons. When they have stood one month, I have varnished a pannel with varnish from the surface of each, when I have found every one of the pannels dry firm in regular time, and have no appearance of pin-holes whatever. On the same day I have taken out fifty gallons of varnish from each cistern. I then, out of the cisterns, which had 100 gallons left in each, varnished a pannel. I found all these dry in the same time as the first, but every pannel was either more or less sleepy or steamy, and appeared as if a fine mist had carried off the glossiness.

After taking out forty gallons more from each cistern, there were only sixty gallons left in each. I then varnished a pannel from each cistern; none of them dried so soon by two hours, and every pannel was opaque and full of pin-holes. I repeated the same experiment from different cisterns of varnish many times, at various periods from the varnishes being made, from one month's age to twelve, and have invariably found that the varnish within fifteen inches of the surface is more perfect and sooner ready for use than that beneath it, and that the varnish towards the bottom of all cisterns requires time and the action of warm air to cause the moisture, acid, and driers, to settle before the varnish is fit to use.

Concluding Observations.

N. B. All body varnishes are intended and ought to have 1½ lbs. of gum to each gallon of varnish, when the varnish is strained off and cold; but as the thinning up, or quantity of turpentine required to bring it to its proper consistence, depends very much upon the degree of

boiling it has undergone, therefore, when the gum and oil have not been strongly boiled, it requires less turpentine to thin it up; whereas, when the gum and oil are very strongly boiled together, a pot of twenty gallons will require perhaps three gallons above the regular proportionate quantity; and if mixing the turpentine is commenced too soon, and the pot not sufficiently cool, there will be frequently above a gallon and a half of turpentine lost by evaporation.

All carriage, wainscot, mahogany, &c. varnish ought to have full one pound of gum for each gallon, when strained and cold; and should one pot require more than its proportion of turpentine, the following pot can easily be left not quite so strong boiled, then it will require less turpentine to thin it up.

Gold sizes, whether pale or dark, ought to have full half a pound of good gum to each gallon when it is finished; and best black japan to have half a pound of good gum, or upwards, besides the quantity of asphaltum. The foregoing proportions I have found to answer best in general; but, recollect, if the gum either be of such inferior quality that it will not properly fuse, or if it should, through inexperience or neglect, not be properly fused, however good the quality, the produce will be both inferior and deficient. And I am perfectly convinced, from forty years' experience, that the greatest and most essential art belonging to the business of varnish-making consists in the management and regulation of the fire in the gum-furnace, so that the gum, from the beginning of its softening in the gum-pot, and during the whole time of its fusion, shall be so managed, according to the nature and quality of that particular sort, particularly in increasing the heat, that it shall carry up and out of the pot all, or as much of, the gas and acid as is possible, which is the most difficult for an inexperienced person to understand, and, indeed, very few think about it.

Every varnish maker, during the time his furnaces are at work, ought always to have his assistant at hand, whether he is wanted or not; and when any thing is to be done quickly, such as lifting a pot from the fire, pouring, or any thing that requires two persons, never do any thing in a hurry or flutter, but always be cool, collected, and firm; and to insure against accidents, be prepared to meet them deliberately. A nervous or timorous person is unfit either for a maker or assistant, and the greatest number of accidents occur either through hurry, fear, or drunkenness.

Fine Mastic or Picture Varnish.

Put 5 lbs. of fine picked gum-mastic into a new four-gallon tin bottle; get ready 2 lbs. of glass bruised as small as barley; wash it several times; afterwards dry it perfectly, and put it into the bottle with two gallons of turpentine that has settled some time; put a piece of soft leather under the bung, lay the tin on a sack upon the counter, table, or any thing that stands solid; begin to agitate the tin, smartly rolling it backward and forward, causing the gum, glass, and turpentine, to work like a barrel-churn for at least four hours, when the varnish may be emptied out into any thing sufficiently clean, and large enough

to hold it. If the gum is not all dissolved, return the whole into the bottle and agitate as before, until all the gum is dissolved; then strain it through fine thin muslin into a clean tin bottle; leave it uncorked, so that the air can get in, but no dust; let it stand for nine months at least before it is used, for the longer it is kept the tougher it will be, and less liable to chill or bloom. To prevent mastic varnish from chilling, boil a quart of river-sand with two ounces of pearl-ashes, afterwards wash the sand three or four times with hot water, straining it each time; put the sand on a soup-plate to dry in an oven, and when it is of a good heat, pour half a pint of hot sand into each gallon of varnish, and shake it well for five minutes; it will soon settle and carry down the moisture of the gum and turpentine, which is the general cause of mastic varnish chilling on paintings.

Common Mastic Varnish.

Put as much gum mastic, unpicked, into the gum-pot as may be required, and to every $2\frac{3}{4}$ lbs. of gum pour in one gallon of cold turpentine; set the pot over a very moderate fire, and stir it with the stirrer; be careful, when the steam of the turpentine rises near the mouth of the pot, to cover it with the carpet, and carry it out of doors, as the least steam will catch fire: a few minutes low heat will perfectly dissolve 8 lbs. of gum, which will, with four gallons of turpentine, produce, when strained, four and a half gallons of varnish, to which add, while yet hot, five pints of pale turpentine varnish, which improves the body and hardness of the mastic varnish.

Another Cheap Varnish for Paper-hangings.

Put into the gum-pot 10 lbs. of gum cat's-eye, with four gallons of turpentine, and at a low heat dissolve it like the mastic; then strain it into the cistern or tin. After having washed out the gum-pot, and wiped it clean, dissolve 5 lbs. of unpicked gum mastic in two gallons of turpentine, and strain it warm into the cat's-eye varnish. After washing and wiping out the gum-pot as before, dissolve 10 lbs. of good white frankincense with four gallons of turpentine, strain it, and, while hot, add this to the two former products; stir them together, take a little out in a saucer, and if too thick, thin it with turpentine until of a proper consistence: when boiled, it may be used, but it is better for age. This may be made excellent at the cost of 10*s.* per gallon.

Crystal Varnish

May be made either in the varnish house, drawing room, or parlour. Procure a bottle of Canada balsam, which can be had at any druggist's; draw out the cork, and set the bottle of balsam at a little distance from the fire, turning it round several times until the heat has thinned it; then have something that will hold as much as double the quantity of balsam, carry the balsam from the fire, and, while fluid, mix it with the same quantity of good turpentine, and shake them together until they are well incorporated: in a few days the varnish is fit for use, particularly if it is poured into a half-gallon glass or stone

bottle, and kept in a gentle warmth. This varnish is used for maps, prints, charts, drawings, paper ornaments, &c., and when required to be made upon a larger scale, requires only warming the balsam to mix with the turpentine.

White hard Spirit of Wine Varnish.

Put 5 lbs. of gum sandarach into a four gallon tin bottle, with two gallons of spirits of wine, 60 over proof, and agitate it until dissolved, exactly as directed for the best mastic varnish, recollecting, if washed glass is used, that it is convenient to dip the bottle containing the gum and spirits into a copper full of hot water every ten minutes, the bottle to be immersed only two minutes at a time; it will greatly assist the dissolving of the gum; but, above all, be careful to keep a firm hold over the cork of the bottle, otherwise the rarefaction will drive the cork out with the force of a shot, and perhaps set fire to the place. The bottle, every time it is heated, ought to be carried away from the fire, then ease the cork a little, to allow the rarefied air to escape; then drive it tight, and continue the agitation in this manner until all the gum is properly dissolved, which is easily known by having an empty tin can to pour the varnish into, until near the last, which pour into a gallon measure; and if the gum is not all dissolved, return the whole into the four-gallon tin, and continue the agitation until it is ready to be strained, when every thing ought to be quite ready, and perfectly clean and dry, as oily tins, funnels, strainers, or any thing damp, or even cold weather, will chill and spoil the varnish. After it is strained off, put into the varnish one quart of very pale turpentine varnish, and shake and mix the two well together. Keep spirit varnishes well corked; they are fit to use the day after being made.

Brown hard Spirit Varnish

Is made by putting into a bottle 3 lbs. of gum sandarach, with 2 lbs. of shell-lac, and two gallons of spirits of wine, 60 over proof; proceed exactly as before directed for the white hard varnish, or by agitating it when cold, which requires about four hours' time, without any danger of fire; whereas making any spirit varnish by heat is always attended with danger. No spirit varnish ought to be made either near a fire or by candle-light. When the brown hard is strained, add one quart of turpentine varnish, and shake and mix it well; next day it is fit for use.

Gold Lacker.

Put into a clean four-gallon tin, 1 lb. of ground turmeric, $1\frac{1}{2}$ ounce of powdered gamboge, $3\frac{1}{2}$ lbs. powdered gum sandarach, $\frac{3}{4}$ lb. of shell-lac, and two gallons of spirits of wine. After being agitated, dissolved, and strained, add one pint of turpentine varnish, well mixed.

Red Spirit Lacker.

2 gallons of spirits of wine,
1 lb. of dragon's blood,

3 lbs. of Spanish annato,
3¼ lbs. gum sandarach,
2 pints of turpentine.

Made exactly as the yellow gold lacker.

Pale Brass Lacker.

2 gallons of spirits of wine,
3 ounces of Cape aloes, cut small,
1 lb. of fine pale shell-lac,
1 ounce gamboge, cut small,
No turpentine varnish.

Made exactly as before; but observe, that those who make lackers frequently want some pale and some darker, and sometimes inclining more to the particular tints of some of the component ingredients. Therefore, if a four ounce vial of a strong solution of each ingredient be prepared, there can be at any time produced a lacker of any tint required.

Having so far given plain and particular directions, it will be very easy for the operator to modify, or make any intermediate proportion or alteration, according to his judgment or inclination.

¶ *Steamboats on the Western Waters.*

In a publication made by the writer of this article in 1829, on the interesting subject of steamboats, it was calculated that from the time of their first introduction on the western waters in 1811, until that period, their number amounted to about three hundred and twenty-three. Their united tonnage was estimated at fifty-six thousand tons. From the best data which could be procured from the most intelligent sources, the original cost of these boats was five millions six hundred thousand dollars, and the repairs on the same number, assuming that none of them would last longer than 1832, was set down at two millions eight hundred thousand dollars. Now, although there were five or six boats built between the years 1811 and 1817, the latter period may be assumed as the epoch of their regular and successful introduction; in 1825 they were brought to their present state of perfection. It results, then, that the amount expended for the building and repairing of steamboats, in a period of about eleven years, was equal to eight millions four hundred thousand dollars. As the number of steamboats was increasing yearly, no fixed amount can easily be assumed for the yearly expenses, but for the year 1829, the sum was fixed at two millions five hundred thousand dollars; if, then, five hundred thousand dollars be considered as a fair yearly average from 1818, the total amount of money expended on the shores of the western waters, up to 1829, inclusive, will be little short of fourteen millions of dollars. When it is considered that this circulation and expenditure of money was exclusively created by the introduction of the steamboat, the importance of this invention to the

Valley of the Mississippi, may be conceived. It has produced an advance of prosperity that would have required more than a century to have realized in the ordinary progress of human affairs; it has produced a revolution in business little inferior in importance to that which followed the discovery of the art of printing.

On the first of January, 1834, an official list of steamboats, from an authentic source, gives the whole number of two hundred and thirty, whose aggregate amount of tonnage is equal to about thirty-nine thousand tons. Allowing the cost of building at a rate much lower than the rule adopted three years since, the capital now invested in this stock will exceed three millions of dollars. The expense of running may be put down nearly as contained in the following scale:—

60 boats over 200 tons, 180 running days, at $140 per day,	$1,512,000 00
70 boats from 120 tons to 200, 240 running days, $90 per day,	1,512,000 00
100 boats under 120 tons, 270 running days, $60 per day,	1,620,000 00
Total yearly expense,	4,644,000 00

This sum may be reduced to the different items producing it in the following proportions, viz:

For wages, 36 per cent., equal to	$1,671,840 00
" wood, 30 per cent., equal to	1,393,200 00
" provisions, 18 per cent., equal to	835,920 00
" contingencies, 16 per cent., equal to	743,040 00

This result is truly striking to those who were accustomed to the state of things on our rivers within twenty years. The difference in the amount of wages paid, is in itself very considerable; but the item of fuel is one created exclusively by steamboats; and when it is considered that nearly one million and a half is expended every year, at a few points on the Mississippi Valley, it presents a vast field for speculation. The immense forests of beech and other timber unfit for agricultural purposes, were, before, not only useless, but an obstacle to the rugged farmer, who had to remove them before he could sow and reap. The steamboat, with something like magical influence, has converted them into objects of rapidly increasing value. He no longer looks with despondence on the denseness of the trees, and only regrets that so many have already been given to the flames, or cast on the bosom of the stream before him.

At the present period, the steamboats may be considered as plying as follows, viz:

25 over 200 tons, between Louisville, New Orleans, and Cincinnati, measuring	8484 tons.
7 between Nashville and New Orleans, measuring	2585 "
4 between Florence and New Orleans,	1617 "
4 in the St. Louis trade,	1002 "
7 in the cotton trade,	2116 "

57 boats not in established trades, from 120 to 200 tons, 8641 tons.
The balance under 120 tons in various trades, 14655 "

39,000

In the New Orleans and Louisville trade, the boats over two hundred tons make about one hundred and forty trips, in prosperous seasons; those of smaller size, make from fifty to sixty trips But to go into an estimate of the number of voyages made by the boats in the different trades, is impossible, because no regular data are furnished, and the result depends upon a variety of contingencies.

Previous to the introduction of the steamboat in 1817, about twenty barges, averaging one hundred tons, afforded the only facilities for transporting merchandise from New Orleans to Louisville and Cincinnati. These making but one trip within the year, gave the means of bringing up only two thousand tons. The present tonnage in this trade exclusively, having been stated to be 8484 tons, gives the amount employed, amounting to one hundred and forty trips in the season, to be 1,187,760 tons; a cause capable of producing a revolution in sixteen years hardly equalled in the annals of history. The effects of these causes upon western commerce have necessarily been immense. The moral changes alone are felt throughout the west, and the effect on prices is almost incalculable: the imported article has fallen in a ratio equal to the increased price of western products. In looking back to the old means of transportation, we cannot conceive how the present demand and consumption could have been supplied by them.

To those who are acquainted with the early mercantile history of our country, when it was no uncommon thing for a party of merchants to be detained in Pittsburgh from six weeks to two months by low water and ice, the existing state of things is truly gratifying. The old price of carriage of goods from the Atlantic seaboard to Pittsburgh, was long estimated at from five to eight dollars for one hundred pounds. We have instances in the last five years, of merchandise being delivered at the wharf of Cincinnati, from Philadelphia by the way of New Orleans, for one dollar per hundred.

It may not be useless, or uninteresting, to give an idea of the *mortality* among steamboats in a given time. It is not pretended that any decided inference can be drawn from this statement, or that the facts go to establish any fixed rule. But under the present situation of steam-boat discipline and regulations, a tolerably fair conclusion can be drawn from it. Taking the period, then, of two years from the fall of 1831 till that of 1833, we have a list of boats gone out of service of sixty-six: of these, fifteen were abandoned as unfit for service; seven were lost by ice; fifteen were burnt; twenty-four snagged, and five destroyed by being struck by other boats. Deducting the fifteen boats abandoned as unseaworthy, we have fifty-one lost by accidents peculiar to the trade. In number, this proportion is over twelve per cent. per annum: in tonnage, the loss is upwards of ten per cent. Amount snagged, 3721 tons; amount burned, 2330 tons.

The foregoing calculations and statements afford great field for

speculation. It is evident that there is a vast amount of surplus tonnage, and, of course, the business at present is entirely overdone. Indeed, from a full investigation of the subject, a few years since, by a committee appointed for the purpose, it was fully ascertained that, although the benefits conferred on the Valley of the Mississippi were incalculable, the stock invested in boats was, as a general rule, a losing investment; in many cases, a total sacrifice. In a few cases, owing to a fortuitous combination of circumstances, money has been made; but the instances are so few as not to affect the rule. Time may correct this evil; but in a business in which public interest and public safety are so much concerned, a little governmental interference and assistance might be useful, and ought to be tendered. Some legislative action, which might tend to arrest the fearful increase of accident, has long been a desideratum; but how this is to be applied, presents the great difficulty. An experiment, however, has been tried, which seems to hold out the prospect of success. We allude to the company which was formed in 1832-3, called the Ohio and Mississippi line of transportion. During the existence of this company, not an accident of any kind occurred to person or property. A perfect regularity in arrivals and departures was introduced, and as all the good boats were in the same interest, there was no foolish rivalship, and consequently no injudicious racing. How far the post-office department would be justifiable in aiding such an association, we do not pretend to say; but in our humble view of the case, we consider the great interests of the west are much involved in the question; and when the great uncertainty and irregularities of the mail, which have hitherto distinguished the routes between New Orleans, Natchez and St. Louis, and Pittsburg, Louisville and Cincinnati, are considered, something is expected. On the score of economy alone, the subject is worthy of the reflection of the general government. Probably nine-tenths of the correspondence on the western waters is of a commercial character; the greatest portion of this is now transmitted, free of postage, by the means of passengers: no one can prevent this. If a line of steamboats can be made interested in protecting the government, the general post-office would find it to its advantage to give liberal terms to such an establishment. N.

[*West. Mag.*

¶ *Manufacturing Establishments at Cincinnati, (Ohio) in* 1834.

There are more "manufacturing establishments" in this city than in any city or town in the west. Pittsburgh ranks next to us in that respect, and perhaps is ahead of us, when we take into consideration the difference of population. Cincinnati has a third more inhabitants than Pittsburgh. We have twelve or thirteen foundries and engine factories, for the manufacturing of engines for steamboats, flour mills, grist mills, rolling mills, and for blast furnaces, used in this section of country, and for sugar mills, corn mills, cotton gins, saw mills, and other uses, for the south, where an immense amount is exported

yearly. An estimate was made in 1832, for the year previous, of the amount exported of articles of the above description, and it exceeded $400,000.

We have also a large and extensive rolling mill, owned and conducted by Messrs. Shreve, Paull and M'Candless, gentlemen of great enterprise, who employ about one hundred men. They cut some ten to eleven tons of nails per week, and roll sixty to seventy tons of iron per week—an extensive and complete spade and shovel factory—seven or eight bell and brass foundries, where an almost unlimited amount of work is done—twelve steam saw mills, all of which are conducted on a very large scale; at most of them there are machines connected for cutting laths, shingles, &c.—5 to 7000 laths can be cut in an hour. At some of these mills they have a saw for cutting boards and timber, a circular saw, and a machine for planing flooring boards, all driven by steam power.

Two flour mills, one owned by C. Bradbury, Esq., and driven by water from the canal—they make sixty or seventy barrels every twenty-four hours. Connected with this establishment, is an oil mill, for the manufacturing of linseed and castor oils; there is also a mill connected for grinding and sifting corn meal, large quantities of which are barrelled and exported. Our largest and most extensive flour mills in this section of the state are on the big and little Miami rivers, which empty into the Ohio, above and below this city, and are situated from ten to fifty miles from Cincinnati; they manufacture, some 100, some 150, and some 200 barrels, every twenty-four hours. All this flour is sent to this market by canal and wagons, and then exported to New Orleans, the Atlantic cities, &c. The other flour mill in the city is worked by steam, and can manufacture, when in operation, 150 barrels per twenty-four hours. I would stop here to remark, that there are about sixty steam engines in constant operation within the corporation lines, exclusive of those on our steamboats, and *all* high pressure; low pressure engines are not in good repute in the west.

A card manufactory, owned by M. P. Cassilly, Esq., where every description of machine cards are made. A large number of establishments for the manufacture of steam boilers, where hundreds of men are constantly employed. A stereotype foundry, and also a large and extensive type foundry, owned by N. Guilford, Esq., and others, where is manufactured every variety of type, printing presses, and every article connected with the printing business; there are eleven or twelve machines for cutting type, and sixty to seventy hands are constantly employed; they manufacture to the amount of some 50 to 60,000 dollars per year.

A steam fire engine factory, owned and conducted by Messrs. Chase and Seymour. The engines manufactured by them are equal for power, beauty, and workmanship, to any manufactured east of the mountains.

A patent lever lock factory, by Messrs. Shawk and Fitz.

A steel saw and file factory, by Messrs. Garrard & Co.

A printing press manufactory, on an extensive scale, by S. Dickinson.

A saddle tree manufactory, machinery driven by steam, conducted by Messrs. Kendall & Co.

A clock factory, by Lerman Watson, Esq., where is manufactured clocks, both of brass and wood. The establishment is a large one; many hands are employed, and many clocks made, of every description.

A factory for rolling sheet lead, and drawing lead pipes, by steam, for hydraulic purposes.

A Steam, Stone Saw Mill.—This establishment is worked on a new principle, and is patented to the proprietor, (Mr. Jas. Henderson.) It cuts stone with great accuracy.

A white lead manufactory, by steam power, owned by James M'Candless, Esq.

A bark, and leather rolling, mill, owned by the Messrs. Clarks, and worked by steam. The manufacture of malt liquors is carried on very extensively in the city, and to great perfection. There are eight very large breweries, and the beer, porter, and ale, manufactured by them, is equal to any I have ever seen in the eastern cities. We have a great number of snuff and tobacco manufactories, last factories, candle and soap factories, &c. Hats, furniture, etc., are manufactured in great quantities, and exported for sale to Kentucky, Tennessee, Mississippi, Louisiana, and every state south and west of us.

My limited information on the subject of manufactories, as well as want of time, will prevent me from giving you a more minute account of the manufacturing and mechanical business, carried on to a very great extent, and to equally great perfection, in Cincinnati. I have named a few, and only a few, of the largest establishments, those that have come to my mind while writing; there are many others, where great numbers of hands are employed, that I do not at this moment think of. Opposite the city, at Newport, is a large cotton bagging factory. It is on a very extensive scale, owned by an incorporated company, with a capital of half a million. They manufacture bagging, bale rope, twine and cordage, Kentucky jeans, cotton and woollen coarse goods, sheet lead and pipe—all of which is carried on by steam power. The machinery, when in full operation, will use annually 450 tons of hemp, 850 bales of cotton, 95 tons of wool, and 200 tons of lead. The agent resides, and transacts all the business of this establishment, in Cincinnati. There is also in Newport, a steam saw mill.

In Covington, also opposite to this city, is a large cotton factory, owned by C. Macalister & Co., of this city; they run 2500 spindles, and manufacture 300,000 lbs. cotton yarn per annum. Sixty hands are employed. The yarn is sold here. There is also in Covington, a rolling mill, on a large scale, a rope walk, steam flour mill, and a steam saw mill. [*Patriot.*

¶ *On Silk.*

Mr. Editor,—As the culture of silk is becoming of considerable importance in our country, it may not be altogether uninteresting to

some of your readers to present them a few remarks concerning its early history.

Previous to the sixth century, the art of rearing silk worms was unknown in Europe. Some small quantity of silk stuffs had been brought to the Italian states, from Asia, but only persons of the first rank were able to procure them. Some idea may be formed of their scarcity, and the great estimation in which they were held, from the fact that, in ancient Rome, under Aurelius, A. D. 270, a pound of silk was considered equal in value to a pound of gold.

In the sixth century, Justinian introduced the art of rearing silk worms into Greece, which rendered the commodity somewhat more plentiful; yet the supply was greatly inadequate to the demand, and it continued an article of luxury and magnificence, reserved for persons only of the first order, or for public solemnities.

This is the first of its culture in Europe, and it was not until the beginning of the twelfth century that it was carried into the neighbouring countries—a proof of the averse disposition of mankind to depart from the "beaten track of life." In the year 1130, Roger I., king of Sicily, carried off a number of artificers in the silk trade, from Athens, and, settling them in Palermo, introduced the culture of silk into his kingdom, from which it was communicated to other parts of Italy. From this period, silk increased in plentifulness throughout Europe, and, in the sixteenth century, silk worms were introduced into this country. Thus, an article which was originally confined to the half civilized countries of Asia, has at length become diffused over Europe and America, promoting the comfort and prosperity of the people. [*Southern Planter.* B.

CELESTIAL PHENOMENA, FOR DECEMBER, 1834.

Calculated by S. C. Walker.

Day.	H'r.	Min.				
8	5	5	Im. 33 *s* Piscium,	,5,	N148°	V119°
8	6	28	Em.		284°	276°
10	13	5	Im. 106 ♑ Piscium,	,6,	69°	118°
10	13	53	Em.		341°	32°
11	12	20	Im. 24 ξ' Arietis,	,6,	188°	234°
11	12	44	Em.		224°	274°
11	13	32	Im. (85) Arietis,	,6,	113°	164°
11	14	31	Em.		287°	338°
18	17	29	Im. ♋ Cancri,	,5,	0°	54°
18	17	54	Em.		318°	13°
19	9	35	N. App. ☽ and — Leonis, 7,		☽ S. 0′,3 or cont't.	
20	10	46	" " ☽ and 42 Leonis, 6,		☽ N. 2′, 2	
20	16	48	Im. 42 *i* Leonis,	,6,	46°	53°
20	18	04	Em.		252°	279°
24	13	46	Contact ☽ and 238 Virginis, 7, or short occult'n.			

New Invention.—The proverb realized, "The Cart before the Horse."

HEIDELBURG, Aug. 15.

In the month of May last, there was seen in the streets of Manheim, a horse pushing before him a carriage, guided with much address by Baron Drais, the author of this invention, which is attended with great advantages:—1. The horse cannot run away. 2. The carriage is not exposed to the dust and dirt generally thrown up by the horse. 3. The prospect is not interrupted by the coachman and the horses. 4. The conversation of the travellers cannot be overheard by the coachman. 5. The travellers are not incommoded by the fumes of the tobacco, &c. The coach-box will be placed on the roof of the carriage, behind, and, by means of a looking-glass, the driver is able to guide the vehicle. This invention is applicable to carriages drawn by four horses.

Meteorological Observations for September, 1834.

Moon	Days.	Therm. Sun rise.	Therm. 2 P.M.	Barometer. Sun rise.	Barometer. 2 P.M.	Wind. Direction.	Force.	Water fallen in rain.	State of the weather, and Remarks.
				Inches.	Inches.			Inches.	
	1	63°	69°	29.90	29.90	NE.	Moderate.	0.05	Rain.
	2	64	69	29.93	30.00	E.	do.	0.10	Drizzle.
	3	63	73	30.00	30.00	SE.	Calm.		Cloudy day.
	4	70	80	.15	.15	SE.	Moderate.	0.25	Cloudy—fog—rain in night.
⊗	5	74	73	.00	.00	W.	do.	0.25	Rain.
	6	70	80	.05	.05	S. NE.	do.		Clear day.
	7	69	82	29.80	29.75	W.	Calm.		Cloudy—thunder shower.
	8	63	79	.85	.85	SE.	do.		Drizzle—showers.
	9	73	76	.90	.90	NE.	Moderate.	1.25	Cloudy—showers.
	10	60	68	.20	.20	SW.	do.	0.07	Cloudy—lightly cloudy.
	11	52	63	.65	.65	W.	Brisk.		Clear day.
☾	12	46	62	.90	.90	W.	do.		Clear—lightly cloudy.
	13	51	66	30.30	30.30	SW.	Moderate.		Cloudy—clear.
	14	51	68	.31	.35	S.	do.		Clear day.
	15	54	69	.30	.31	W.	do.		Clear day.
	16	50	71	.30	.31	SW.	do.		Clear day.
	17	53	69	29.90	29.90	E.	do.	0.25	Cloudy—rain.
	18	58	70	.90	.75	SE.	do.		Cloudy day.
☉	19	68	72	.93	.85	SE. SW.	do.	0.10	Rain—clear.
	20	57	72	.85	.90	W.	do.		Clear day.
	21	58	72	.85	.80	NE.	do.		Clear—lightly cloudy.
	22	56	70	.80	.80	NE.	do.		Clear day.
	23	72	75	.80	.75	S.	do.		Cloudy—drizzle—flying clouds.
	24	58	64	.90	.95	NE.	do.		Cloudy day.
	25	56	70	30.00	30.00	W.	do.		Lightly cloudy.
	26	54	71	.00	.14	SE.	do.		Drizzle—clear.
	27	69	70	29.90	29.90	SE. SW.	do.		Cloudy—clear.
	28	58	54	.90	.95	NE.	do.		Lightly cloudy.
	29	44	55	29.90	30.10	NW.	do.		Drizzle—clear.
	30	38	62	.95	.34	SW.	Blustering		Cloudy—rain.
	Mean	59.03	69.07	29.96	30.06		Moderate.	3.37	Clear day.
								0.15	White frost—clear.

Thermometer.			Barometer.
Maximum height during the month,		82. on 7th,	30.65 on 5th.
Minimum	do.	38. on 30th.	29.65 on 10th.
Mean	do.	64.05	29.98